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A Subsidiary of Northrop Corporation

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INSTRUCTION MANUAL
FOR CONVERSION OF NORLANT
FSK-2 AND FGC-5 EQUIPMENT
TO 8-CHANNEL OPERATION

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1. INTRODUCTION

The purpose of this manual is to give instructions for the conversion of the NORLANT radio and multiplexing equipment from 2, 3, or 4 channels of 60-wpm teletype information into a 4-, 6-, or 8-channel system. The conversion is accomplished by increasing the bandwidth and improving the performance of the FSK-2 receiver and by combining two 4-channel FGC-5 units into a single 8-channel unit. No changes are necessary in the FSK-2 exciter.

Circuit quality at the 8-channel rate should be better than the unmodified 4-channel rate. Also, the modified 4-channel rate should be considerably better than the unmodified 4-channel rate because of improvements made in the FSK-2 receiver.

While this manual is designed for a specific NORLANT combination of equipments, it should be understood that the conversion instructions for the FGC-5 Telegraph Terminal Set permits its conversion in any radio link with sufficient bandwidth to support 8 channels of information. Furthermore, conversion of the FSK-2 receiver improves its performance by 3 db, or better, at the 4-channel rate, and permits its use with other multiplex equipment requiring increased bandwidth. Modifications to the FGC-5 are based on information in the manual, "Modification Information For The AN/FGC-5 Telegraph Terminal Set," compiled by the 1823 AACS Group, Directorate of Engineering, Andrews Air Force Base, Washington, D. C.

This manual supplements the following publications: Navships 91265(A), "Instruction Book For Telegraph Terminal Set AN/FGC-5;" The National Company's "Instructions For Operation and Maintenance of Frequency Shift Keyed Radio Communication System Type FSK-2 (1 September 1955);" and the Page manual, "Supplement to the Instruction Book for the Type FSK-2 Dual Diversity Receiving and Excitation Equipment (PCE-M-4315)."

2. FGC-5 MODIFICATIONS

2.1 General Description

The modified transmitting group consists of two OA-151 transmitting groups interconnected to produce a composite signal with each information element in 8-channel operation being half the length used in 4-channel operation. Information from the circuits connected to code convertors in the second transmitting group is transmitted in time sequence after the multiplexed information from convertors in the first group. The two OA-150 receiving groups are connected similarly.

The modified telegraph terminal can be operated to multiplex 4, 6, or 8 channels of 60-wpm telegraph traffic. Operation in the 4-channel mode allows the receiving station to reduce the detector bandwidth, thus reducing interference and noise to a greater extent than possible with 8-channel operation. Since the information pulses are of greater duration in the 4-channel mode, the receiving system is more immune to self-interference from multipath propagation. Under normal conditions, 8-channel operation may be used; 6-channel operation represents a compromise between 4- and 8-channel operation. The send and receive equipment may be switched independently to reduce channels, as required by the propagation conditions.

2.1.1 Transmitting Signal Distributor TT-58/FGC-5. The channel distributors of Transmitting Signal Distributors Nos. 1 and 2 are connected in tandem for 6- or 8-channel operation. The Unit No. 2 impulse distributor is not used since the selection impulses are obtained from the Unit No. 1 impulse distributor. Drive Pulse Amplifier V-513 of Unit No. 1 supplies the drive for both sections of the 8-channel distributor, at twice the 4-channel rate. Multiplexed informa-

tion from the matrix tubes in Signal Distributor Unit No. 2 is returned to the mixer tube of Unit No. 1, and the output is taken through the Unit No. 1 Control Monitor. Switch S-504 is added in the Unit No. 1 Signal Distributor to include the Unit No. 2 channel distributor tubes in the circuit for 6- or 8-channel operation.

2.1.2 Receiving Signal Distributor TT-64/FGC-5. Changes to the two Receiving Signal Distributor units are similar to those made in the Transmitting Group. A change was made in both receiving units to square the channel distributor gate pulse to provide a stronger pulse to the first matrix tube in each of the eight matrix circuits.

2.1.3 Transmitting Signal Distributor Drive O-101/FGC-5. The Transmitting Signal Distributor Drive in the Unit No. 1 equipment was modified to provide drive impulses at 150 impulses per second (ips) for 4-channel operation, 225 ips for 6-channel operation, and 300 ips for 8-channel operation. Divider stage V-104A, formerly used for 3-channel drive, was changed to a locking oscillator with a free running frequency of 300 cycles by reversing the connections to L-107, retuning, and providing a 150-cycle synchronizing signal from V-103B. The center position of switch S-101 is now used for 8-channel drive. The 6-channel drive is obtained by dividing the 450-cps signal from V-103A by two in the divider stage V-107. The former 2-channel position of the channel switch is used for 6-channel operation. The Unit No. 2 Signal Distributor Drive is not used.

2.1.4 Receiving Signal Distributor Drive O-100/FGC-5. Changes to Unit No. 1 Receiving Signal Distributor Drive are the same as those made in the corresponding transmitting unit. The Unit No. 2 Signal Distributor Drive is not used.

2.1.5 Transmitting Control Monitor C-620/FGC-5. The frequency meter of Unit No. 1 Transmitting Control Monitor now indicates half

the frequency of the distributor driving pulses; that is, 75, 112.5, or 150 for 4-, 6-, or 8-channel operation. The Unit No. 2 Control Monitor is not used.

2.1.6 Receiving Control Monitor C-621/FGC-5. The Unit No. 1 Receiving Control Monitor was modified exactly the same as the corresponding transmitting unit. The Unit No. 2 Control Monitor is not used.

2.2 Modification Instructions

2.2.1 Transmitting Signal Distributor, Unit No. 1 (See Figure 2-38)

(1) Remove the two spare fuse holders, F-501 and F-502.

(2) Mount receptacle J-507A, Amphenol AN-3102A-22-14S, in the space occupied by F-501 and F-502. See Figure 2-1.

(3) Install a 2-inch square of aluminum under the chassis to cover the hole next to the channel switch, S-501. Have a 3/8-inch hole drilled in the center of the plate for mounting the added channel switch, S-504A, Centralab No. 1011. See Figures 2-1 and 2-2.

(4) Connect wire from the top of R-575, TB-503, W-BR lead (A-85), to J-507A, pin A. See Figure 2-3.

(5) Connect wire from the top of R-583, TB-503, W-R lead (A-83), to J-507A, pin B. See Figure 2-3.

(6) Connect wire from the top of R-591, TB-503, W-O lead (A-79), to J-507A, pin C. See Figure 2-3.

(7) Connect wire from the top of R-599, TB-503, W-Y lead (A-75), to J-507A, pin D. See Figure 2-3.

(8) Connect wire from top of R-607, TB-503, W-G lead (A-71), to J-507A, pin E. See Figure 2-4.

(9) Connect wire from the top of R-615, TB-503, W-BL lead (A-66), to J-507A, pin F. See Figure 2-4.

(10) Connect wire from the top of C-521, TB-502, Y lead (C-86), to J-507A, pin G. See Figure 2-5.

(11) Connect wire from the bottom of R-549, TB-502, BL lead (A-62), to J-507A, pin H. See Figure 2-5.

(12) Connect wire from terminal 1 of S-504A to J-507A, pin P. See Figures 2-2 and 2-6.

(13) Connect wire from terminal 4 of S-504A to J-507A, pin J. See Figures 2-2 and 2-6.

(14) Connect wire from terminal 7 of S-504A to J-507A, pin K. See Figures 2-2 and 2-6.

(15) Connect wire from terminal 10 of S-504A to J-507A, pin L. See Figures 2-2 and 2-6.

(16) Connect wire from the junction of C-535 and R-661, TB-505, to J-507A, pin M. See Figure 2-7.

(17) Change value of R-661, TB-505, from 2.2 meg to 1.2 meg. See Figure 2-7.

(18) Number the contacts on S-504A CCW looking from the bottom. Disconnect the W-O-BL lead (A-6) from pin 2 of V-510 (from terminal 11 of S-501A), splice wire onto it, and connect it to terminal 2 of S-504A. See Figure 2-8.

(19) Connect a wire from terminal 5 of S-504A to bottom of R-545, TB-502, Y lead (C-77). See Figure 2-5.

(20) Disconnect the W-BK lead (A-11) from pin G of J-506, splice a new wire onto it, and connect it to terminal 8 of S-504A. See Figure 2-6.

(21) Connect a wire from terminal 11 of S-504A to pin G of J-506. See Figure 2-6.

(22) Strap terminals 3 to 6 and 9 to 12 on S-504A. See Figure 2-6.

(23) Change C-535, TB-505, to 500 μμf. If interconnecting cable with more than 200-μμf capacitance is required, change C-535 for a total capacitance of 700 μμf or less.

(24) Mark S-504A for 4-channel operation in the CW position, and 6- to 8-channel operation in the CCW position.

(25) Mark S-501 for 4-, 6-, and 8-channel operation in the CW position.

2.2.2 Transmitting Signal Distributor, Unit No. 2 (See Figure 2-39)

(1) Remove the two spare fuse holders, F-501 and F-502.

(2) Mount receptacle J-507A, Amphenol AN-3102A-22-14S, in the space occupied by F-501 and F-502. See Figure 2-1.

(3) Remove the W-BR lead (A-85) from the top of R-575, TB-503, and tape. Connect wire from the terminal to J-507A, pin A. See Figure 2-9.

(4) Remove the W-R lead (A-83) from the top of R-583, TB-503, and tape. Connect wire from the terminal to J-507A, pin B. See Figure 2-9.

(5) Remove the W-O lead (A-79) from the top of R-591, TB-503, and tape. Connect wire from the terminal to J-507A, pin C. See Figure 2-9.

(6) Remove the W-Y lead (A-75) from the top of R-599, TB-503, and tape. Connect wire from the terminal to J-507A, pin D. See Figure 2-9.

(7) Remove the W-G lead (A-71) from the top of R-607, TB-503, and tape. Connect wire from the terminal to J-507A, pin E. See Figure 2-10.

(8) Remove the W-BL lead (A-66) from the top of R-615, TB-503, and tape. Connect wire from the terminal to J-507A, pin F. See Figure 2-10.

(9) Remove the Y lead (C-86) from the top of C-521, TB-502, and tape. Connect wire from the terminal to J-507A, pin G. See Figure 2-11.

(10) Remove the BL lead (A-62) from the bottom of R-549, TB-502 (from pin 7 of V-507), splice wire onto it, and connect it to J-507A, pin H. Remove the other BL lead between R-549 and the junction of R-532 and R-546. See Figure 2-11.

(11) Remove the W lead (A-7) from junction of C-523 and bottom of R-528, TB-50 (from terminal 12 of S-501A), splice wire on it, and connect it to J-507A, pin P. See Figure 2-11.

(12) Connect wire on the junction of C-523 and R-528, TB-502, and connect to J-507A, pin J. See Figure 2-11.

(13) Remove the W-R lead (A-8) from the top of C-524, TB-506 (from terminals 2, 7, and 9 of S-501B), and connect it to J-507A, pin K. See Figure 2-12.

(14) Connect wire from C-524, TB-506, to J-507A, pin L. See Figure 2-12.

(15) Remove strap between bottom of R-660 and C-535, TB-505. See Figure 2-13.

(16) Connect wire from the junction of R-657, R-658, R-659, and R-660, TB-505, to J-507A, pin M. See Figure 2-13.

(17) Remove G lead (B-61) from the bottom of R-657, TB-505, (from pin 2 of V-528), and tape. See Figure 2-13.

(18) Change value of R-588, TB-504, from 470K to 820K. See Figure 2-14.

19) Disconnect the strap between right-hand end of R-588 and bottom of R-635, TB-504. See Figure 2-14.

(20) Remove the Y lead (B-40) and the W-O lead (B-41) from pin 3 of XV-516, splice wire onto them, and connect them to the right-hand end of R-588. See Figures 2-14 and 2-15.

(21) Connect pin 3 of V-516 to ground. See Figures 2-14 and 2-15.

(22) Install a new resistor R-793B, 820K, between the top end of R-586 and the left-hand end of R-588. See Figure 2-14.

(23) Install a new resistor, R-794B, 1 meg, between the top end of R-587 and the left-hand end of R-588B. See Figure 2-14.

(24) Remove tubes V-501, V-502, V-503, V-504, V-505, V-506, V-511, V-513, V-528, and V-529, and cover corresponding sockets with aluminum sheet.

(25) Mark the channel switch, S-501, for 8-channel operation in the CW position, and for 6-channel operation in the CCW position.

2.2.3 Receiving Signal Distributor, Units No . 1 and 2 (See Figures 2-40 and 2-41)

(1) Remove W-O-BL lead from right end of R-719, TB-507, and tape. See Figures 2-16 (Unit No. 1) and 2-17 (Unit No. 2).

(2) Connect right end of R-719, TB-507, to junction of R-714 and C-525 on TB-511. See Figures 2-16 (Unit No. 1) and 2-17 (Unit No. 2).

(3) Remove W lead from right end of R-759, TB-508, and tape.

(4) Connect right end of R-759, TB-508, to junction of R-754 and C-527 on TB-512. See Figure 2-18.

(5) Remove B-94 (W) lead from rear end of R-716, TB-509 and tape. See Figure 2-19.

(6) Connect back end of R-716, TB-509, to bottom of C-524, TB-507. See Figure 2-19 and Figures 2-20 (Unit No. 1) and 2-25 (Unit No. 2).

(7) Remove C-9 (W-O-G) lead from front end of R-756, TB-509, and tape. See Figure 2-19.

(8) Connect front end of R-756, TB-509, to bottom end of C-526, TB-508 (with B-74 Y lead). See Figure 2-19

(9) Connect R-796B, 1.8-meg resistor, from the junction of R-719 and C-553 on TB-507 to the junction of R-753 and R-755 on TB-512. See Figures 2-16 and 2-18 (Unit No. 1), and Figures 2-18 and 2-17 (Unit No. 2).

(10) Connect R-798B, 1.8-meg resistor, from the junction of R-759 and C-565 on TB-508 to the junction of R-753 and R-755 on TB-512. See Figure 2-18.

(11) Connect R-795B, 1.8-meg resistor, from the junction of R-716 and C-552 on TB-509 to the junction of R-753 and R-755 on TB-512. See Figures 2-18 and 2-19.

(12) Connect R-797B, 1.8-meg resistor, from the junction of R-756 and C-564 on TB-509 to the junction of R-753 and R-755 on TB-512. See Figures 2-18 and 2-19.

(13) Resistor and tube variations may require changing the value of some of the above resistors to reduce the spurious matrix output pulses to less than 4 volts.

2.2.4 Receiving Signal Distributor, Unit No. 1 (See Figure 2-40)

(1) Mount receptacle J-509A, Amphenol AN-3102A-22-14S, in the space occupied by spare fuse holders, F-501 and F-502. See Figure 2-21

(2) Mount switch S-506A, Centralab No. 1011, on a 2-inch square piece of aluminum sheet covering the hole next to the channel switch, S-501. See Figures 2-21 and 2-2.

(3) Connect wire from the top of C-553, TB-507, W-BR lead (A-88), to J-509A, pin A. See Figure 2-16.

(4) Connect wire from the top of C-554, TB-507, W-R lead (A-84), to J-509A, pin B. See Figure 2-16.

(5) Connect wire from the top of C-556, TB-507, W-O lead (A-80), to J-509A, pin C. See Figure 2-16.

(6) Connect wire from the top of C-558, TB-507, W-Y lead (A-76), to J-509A, pin D. See Figure 2-16.

(7) Connect wire from the top of C-561, TB-507, W-G lead (A-72), to J-509A, pin E. See Figure 2-20.

(8) Connect wire from the top of C-562, TB-507, W-BL lead (A-68), to J-509A, pin F. See Figure 2-20.

(9) Connect wire from the bottom of R-549, TB-502, BL lead (A-64), to J-509A, pin G. See Figure 2-22.

(10) Connect wire from the top of C-515, TB-502, Y lead (C-72), to J-509A, pin H. See Figure 2-22.

(11) Connect wire from pin 1 of V-533, W-O-BL lead (B-60), to J-509A, pin M. See Figure 2-23.

(12) Connect wire from pin 6 of V-539, BL lead (C-34), to J-509A, pin N. See Figure 2-23.

(13) Number S-506A contacts CCW, looking from the bottom. Disconnect W-O-BL lead (A-19) from pin 2 of V-510 (from terminal 11 of S-501A), splice wire onto the lead, and connect it to terminal 5 of S-506. See Figure 2-24.

(14) Connect wire from terminal 1 of S-506 to J-509A, pin P. See Figures 2-2 and 2-17.

(15) Connect wire from terminal 4 of S-506 to J-509A, pin J. See Figures 2-2 and 2-17.

(16) Connect wire from terminal 10 of S-506 to J-509A, pin L. See Figures 2-2 and 2-17.

(17) Connect wire from terminal 7 of S-506 to J-509A, pin K . See Figures 2-2 and 2-17.

(18) Connect wire from terminal 2 of S-506 to the bottom of R-545, TB-502 (Y lead C-49). See Figures 2-2 and 2-17.

(19) Disconnect the W-BK lead (A-24) from pin G to J-511 (from terminal 8 of S-501B), splice wire onto the lead, and connect it to terminal 11 of S-506. See Figure 2-17.

(20) Connect wire from pin G of J-511 to terminal 8 of S-506. See Figure 2-17.

(21) Strap terminals 3 to 6 and 9 to 12 of S-506. See Figure 2-17.

(22) Mark S-506A for 4-channel operation in the CW position, and for 6- or 8-channel operation in the CCW position.

(23) Mark S-501 for 4-, 6-, or 8-channel operation in the CW position.

2.2.5 Receiving Signal Distributor, Unit No. 2 (see Figure 2-41)

(1) Remove the two spare fuse holders, F-501 and F-502.

(2) Mount receptacle J-509A, Amphenol AN-3102A-22-14S, in the space occupied by F-501 and F-502. See Figure 2-21.

(3) Remove the W-BR lead (A-88) from C-553, TB-507, and tape. Connect a new wire from the terminal to J-509A, pin A. See Figure 2-25.

(4) Remove the W-R lead (A-84) from C-554, TB-507, and tape. Connect a new wire from the terminal to J-509A, pin B. See Figure 2-25.

(5) Remove the W-O lead (A-80) from C-556, TB-507, and tape. Connect a new wire from the terminal to J-509A, pin C. See Figure 2-25.

(6) Remove the W-Y lead (A-76) from C-558, TB-507, and tape. Connect a new wire from the terminal to J-509A, pin D. See Figure 2-25.

(7) Remove the W-G lead (A-72) from C-561, TB-507, and tape. Connect a new wire from the terminal to J-509A, pin E. See Figure 2-26.

(8) Remove the W-BL lead (A-68) from C-562, TB-507, and tape. Connect a new wire from the terminal to J-509A, pin F. See Figure 2-26.

(9) Remove the BL lead (A-64) from the bottom of R-549, TB-502 (from pin 7 of V-507), splice a new wire onto the lead, and connect it to J-509A, pin G. See Figure 2-27.

(10) Remove the Y lead (C-72) from the top of C-515, TB-502, and tape. Connect a new wire from the terminal to J-509A, pin H. See Figure 2-27.

(11) Remove the W-O-BL lead (B-60) from pin 1 of V-533 and tape. Connect a new wire from the pin to J-509A, pin M. See Figure 2-28.

(12) Remove the BL lead (C-39) from pin 1 of V-539 (from R-711) and tape. Connect a new wire from the pin to J-509A, pin N. See Figure 2-28.

(13) Remove the W lead (A-20) from the junction of R-528 and C-523, TB-502, splice a new wire on the lead, and connect it to J-509A, pin J. See Figure 2-27.

(14) Connect a new wire on the junction of R-528 and C-523, TB-502, to J-509A, pin P. See Figure 2-27.

(15) Remove the W-R lead (A-21) from C-524, TB-507, splice a new wire on the lead, and connect it to J-509A, pin L. See Figure 2-27.

(16) Connect a new wire from C-524, TB-507, to J-509A, pin K. See Figure 2-27.

(17) Remove tubes V-501, V-502, V-503, V-504, V-505, V-506, V-511, V-530, V-531, and V-532, and cover sockets with sheet aluminum.

(18) Remove the two BL leads (B-30 and B-40) from pin 1 of V-535, solder together, and tape. See Figure 2-29.

(19) Strap pin 1 to pin 6 of V-535. See Figure 2-29.

(20) Mark S-501 for 8-channel operation in the CW position, and for 6-channel operation in the center position.

2.2.6 Transmitting Signal Distributor Drive, Unit No. 1 (See Figure 2-42)

(1) Remove A-25(G) lead from top of C-126, TB-103, and tape. See Figure 2-30.

(2) Remove the W-G strap between terminal 5 and 7 of S-101 and move the W-G lead (A-9) from terminal 5 (from R-128) to terminal 7.

(3) Install a single terminal tie point under the subchassis mounting screw, located next to R-130. See Figure 2-31.

(4) Connect a new C-152B, 0.1 μf, between the terminal tie point and the bottom of R-130, TB-101, Y lead (B-23). See Figure 2-31.

(5) Connect a new R-211B, 470K resistor, from the terminal tie point to a ground lug on XV-104. See Figure 2-31.

(6) Connect a new wire from the terminal tie point, junction of C-152B and R-211B, to terminal 5 of S-101. See Figure 2-31.

(7) Change value of R-144 and R-147, TB-103, from 220K to 240K. See Figure 2-30.

(8) Remove jumper from XV-104, pin 3, to ground. See Figure 2-32.

(9) Connect resistor R-212B, 560 ohms, from XV-104, pin 3, to ground. See Figure 2-32.

(10) Remove the B-2 (W-G) lead from L-107, terminal 3, and connect it to L-107, terminal 1. See Figure 2-33.

(11) Remove the B-1 (W-BL) lead from L-107, terminal 1, and connect it to L-107, terminal 3. See Figure 2-33.

(12) Change R-124, TB-101, to 100K. See Figure 2-31.

(13) Remove the W-BL lead between the bottom of R-127 and the bottom of R-123, TB-101. See Figure 2-31.

(14) Remove the W-BL lead between the bottom of R-123 and the bottom of R-119, TB-101. See Figure 2-31.

(15) Connect bottom of R-127 to bottom of R-119, TB-101. See Figure 2-31.

(16) Connect capacitor C-153B, 500 μμf, from bottom of R-123 to bottom of R-128, TB-101. See Figure 2-31.

(17) Change C-123, TB-102, to 3300 μμf. See Figure 2-32.

(18) Change C-121 as required for an output frequency of 300 cps with V-103 removed. See Figure 2-32.

(19) Mark the channel switch to indicate 4-channel operation in CW position, 6-channel in CCW position, and 8-channel in center position.

(20) Remove R-210, TB-102. See Figure 2-32.

(21) Connect resistor R-213B, 27K, from XV-104, terminal 1, to ground. See Figure 2-30.

NOTE:

Transmitting Signal Distributor Drive, Unit No. 2, is not used.

2.2.7 Receiving Signal Distributor Drive, Unit No. 1 (See Figure 2-43)

(1) Remove strap between terminal 5 and 7 of S-104A.

(2) Move the A-5 (W-G) wire from terminal 5 to terminal 7 of S-104A.

(3) Change value of R-173, TB-106, from 3.3 meg to 2.2 meg.

(4) Change value of R-133, TB-103, from 470K to 330K. See Figure 2-34.

(5) Change value of R-144 and R-147, TB-103, from 220K to 240K. See Figure 2-34.

(6) Remove A-97 (G) lead from top of C-126, TB-103, and tape. See Figure 2-34.

(7) Install a single terminal tie point under the subchassis mounting screw, located next to C-143. See Figure 2-35.

(8) Connect a new C-152B, 0.1-μf capacitor, between the terminal tie point and the bottom of R-130, TB-101, Y lead (C-1). See Figures 2-36 and 2-35.

(9) Connect a new R-211B, 470K resistor, from the terminal tie point to a ground lug on XV-104. See Figures 2-36 and 2-35.

(10) Connect a new wire from the terminal tie point, junction of C-152B and R-211B, to terminal 5 of S-104A. See Figure 2-36.

(11) Connect a new C-100B, 5000- μμf capacitor, between pin 1 of XV-108 and the ground lug on XV-107.

(12) Remove the strap from XV-104, pin 3, to ground. See Figure 2-33.

(13) Connect resistor R-212B, 560 ohms, from XV-104, pin 3, to ground. See Figure 2-33.

(14) Connect resistor R-213B, 27K, from XV-104, pin 1, to ground. See Figure 2-33.

(15) Remove B-11 (W-G) lead from L-107, terminal 3, and connect it to L-107, terminal 1. See Figure 2-33.

(16) Remove B-12 (W-BL) lead from L-107, terminal 1, and connect it to L-107, terminal 3. See Figure 2-33.

(17) Change R-124, TB-101, to 100K. See Figure 2-33.

(18) Remove the W-BL lead from bottom of R-127 to bottom of R-123, TB-101. See Figure 2-36.

(19) Remove W-BL lead from bottom of R-123 to bottom of R-119, TB-101. See Figure 2-33.

(20) Connect bottom of R-127 to bottom of R-119, TB-101. See Figure 2-36.

(21) Connect capacitor C-153B, 500 μμf, from bottom of R-123 to bottom of R-128, TB-101. See Figure 2-36.

(22) Change C-123, TB-102, to 3300 μμf. See Figure 2-33.

(23) Change C-121 as required for output frequency of 300 cps with V-103 removed. See Figure 2-33.

(24) Remove R-210, TB-102. See Figure 2-33.

(25) Mark channel switch to indicate 4-channel operation in the CW position, 6-channel operation in the CCW position, and 8-channel operation in the center position.

NOTE:

Receiving Signal Distributor Drive, Unit No 2, is not used.

2.2.8 Transmitting Control Monitor, Unit No. 1

(1) Change C-303, TB-301, to 0.02 μf.

(2) Adjust R-309 so meter indicates 150 cps with 300-cps drive.

(3) Mark panel to indicate that meter indications are to be doubled.

2.2.9 Receiving Control Monitor, Unit No. 1

(1) Change C-303, TB-303, to 0.02 μf.

(2) Adjust R-309 so meter indicates 150 cps with 300-cps drive.

(3) Mark panel to indicate that meter indications are to be doubled.

NOTE:

Transmitting and Receiving Control Monitors, Units No. 2, are not used.

2.2.10 Intercabinet Wiring

(1) In the Transmitting Signal Distributors, connect a 6-foot, 12-pair cable by plug P-507A in Unit No. 1 to P-507A in Unit No. 2. See Figure 2-37.

(2) In the Receiving Signal Distributors, connect a 6-foot, 12-pair cable by plug P-509A in Unit No. 1 to P-509A in Unit No. 2. See Figure 2-37.

2.3 Operation and Switching of Modified Equipment

The modified terminal set AN/FGC-5 differs from the 4-channel set by having two additional switches and certain controls whose use has been changed as described below.

2.3.1 Transmitting Equipment. Switch S-101, in the Signal Distributor Drive, is set to the required number of channels, 4, 6, or 8. In Signal Distributor Unit No. 1, switch S-501 remains in position 3 at all times. Switch S-504A (added) is set to position 1 for 6- or 8-channel operation, and to position 2 for 4-channel operation. Switch S-501 in Signal Distribution Unit No. 2 is set to position 1 for 6-channel operation and to position 3 for 8-channel operation. Signal Distributor Unit No. 2 is not used for 4-channel operation.

2.3.2 Receiving Equipment. Switch S-101 in the Signal Distributor Drive is set to the required number of channels, 4, 6, or 8. In Signal Distributor Unit No. 1, switch S-501 remains in position 3 at all times. Switch S-506A (added) is set to position 1 for 6- or 8-channel operation, and to position 2 for 4-channel operation. Switch S-501 in Signal Distributor Unit No. 2 is set to position 1 for 6-channel operation and to position 3 for 8-channel operation. Signal Distributor Unit No. 2 is not used for 4-channel operation.

2.3.3 Switching. In reducing or increasing channels, the switches should be set back to the original position and reset again if the distributor fails to start, as was done with the unmodified set. After the channels have been switched on the transmitting set, the receiving set at the distant terminal is switched in a similar fashion to the same channel capacity; and the receiving set is phased. The patterns indicated when only the channel phasing is incorrect differ somewhat from those described in the AN/FGC-5 manual, since the idle pattern for channel four is "space" on elements one, three, and five, and "mark" on elements two and four in the modified equipment. Switching should be completed in one direction before a change is made in the reverse

direction. The radio receiver bandwidth must also be changed to correspond to the number of channels used in the multiplexing equipment.

2.4 Errata Sheets for NAVSHIPS 91265(A)

The following changes or additions should be made in NAVSHIPS 91265(A), Instruction Book for Telegraph Terminal Set AN/FGC-5:

2.4.1 Section Two: Paragraph 3b(1)(c), second sentence, should read: "The latter consists of eight gas tubes, one for each channel," etc.

2.4.2 Paragraph 3b(1)(d) should read as follows: "The channels switch in the No. 1 transmitting signal distributor is marked for 2-, 3- or 4-channel operation. When modified for 6- or 8-channel operation, no drive pipes are available for 2- or 3-channel operation; therefore, the channels switch must be left in the 4-channel position at all times. There is an added channel switch in the No. 1 transmitting signal distributor for the purpose of including the No. 2 distributor channel tubes in the ring for 6- or 8-channel operation. The switch has two positions, 4-channel and 6-8 channel. If this switch is in the 6-8 channel position, the channel switch in the No. 2 transmitting signal distributor will be used to select either 6- or 8-channel operation."

2.4.3 Paragraph 3b(1)(e) should read as follows: "Twelve double triodes arranged in two groups in both the No. 1 and No. 2 distributors provide the matrices in which the signal pattern is formed. In the No. 1 distributor, corresponding triode sections of one group accommodate A- and B-channel signals, while like sections of the second group accommodate C- and D-channel signals. In the No. 2 distributor triode, sections of one group accommodate E and F channel signals, while like sections of the second group accommodate G and H channel signals. Each matrix tube is controlled," etc.

2.4.4 Paragraph 3b(1)(f) should read as follows: "The output signals on C, D, G, and H channels; the second, third and fourth elements of the signals on A channel; and the second and fourth elements on E channel are inverted through the use of reversed matrix input coupling connections within the distributor unit.

This is done so that the idle signal will contain "reversals" which are used in the maintenance of synchronism at the Telegraph Receiving Group. The A-channel impulses are inverted in a special pattern so that when the receiving signal distributor is being phased, only one position will be found to give intelligible reception on that channel."

2.4.5 Paragraph 3b(6) (a) should read as follows: "When the channel switches are in the proper position for 8-channel operation, the channel distributor consists of gas tubes V-507 to V-510 inclusive in the No. 1 distributor unit, and V-507 to V-510 inclusive in the No. 2 distributor unit, all type GL-5663, connected in a ring circuit of the same type and with individual components of the same values as those in the impulse distributor. Connections may be traced through the switches to cause V-507 of the No. 1 distributor unit to prime V-508, V-508 to prime V-509, V-509 to prime V-510, and V-510 to prime V-507 of the No. 2 distributor unit, and V-507 to prime V-508, V-508 to prime V-509, V-509 to prime V-510, and V-510 to prime V-507 of distributor unit No. 1. Each channel-distributor tube connects its cathode to a corresponding matrix-keyer tube. Each cathode also connects through an isolating capacitor to a transmitting telegraph code converter, thus supplying the operating impulses to the latter unit. Some of these connections pass through the channel numbers switch and it will be found that the A-channel tube connects to the H converter, the B-channel tube to the A converter, the C-channel tube to the B converter, the D-channel tube to the C converter, the E-channel tube to the D converter, the F-channel tube to the E converter, the G-channel tube to the F converter, and the H-channel tube to the G converter."

2.4.6 Paragraph 3b(6) (b) should read as follows: "When the distributor is operating in the 6-channel condition with the G and H channel dropped, the connections from V-509 and V-510 in the No. 2 distributor unit are removed from the other circuits. In this case, V-508 in the No. 2 distributor primes V-507

in the No. 1 distributor, while the grid-conditioning circuit for V-509 and V-510 in the No. 2 distributor is grounded through S-501 to prevent the latter tubes from ever being fired. At the same time, the A-channel tube supplies the F converter operating impulse, while the G and H converters receive no operating impulses."

2.4.7 Paragraph 3b(6) (c) should read as follows: "Under conditions of 4-channel operation, the added channel switch in the No. 1 distributor will cause the priming impulse for V-507 to come from V-510. In this case, the F- and G-channel operating impulses are also discontinued, while the D-channel converter receives its operating impulse from the A-channel tube."

2.4.8 Paragraph 3b(7) (b), second sentence, should read: "Input code signals are received through connectors J-503, J-504, J-505, and J-506 for the A, B, C, and D, and the E, F, G, and H channels, respectively." The seventh sentence should read: "V-518A and V-519A and the B sections of V-514 to V-519 will be found to have similar grid networks and operation, while V-515A, V-516A, and V-517A of distributor No. 1 and V-515A and V-517A of distributor No. 2 have input circuits similar to V-521 to V-526, which will be described."

2.4.9 Paragraph 3b(8) should read as follows: "The common anode circuits for the matrix tubes connect through R-657, R-658, R-659, and R-660 of both distributor No. 1 and distributor No. 2 to grid of mixer tube V-528 in distributor No. 1. Negative bias for the input triode of the 12AT7 is supplied through R-661 from mixer control R-662. V-528 is connected as a regenerative amplifier which triggers around one input potential level, as regulated by R-662. C-535 in the input grid circuit provides some transient filtering to smooth over gaps which otherwise might appear between multiplex signal elements. When a positive potential is applied to grid 2, the input triode of V-528 begins conduction. The potential of anode 1 then drops and, by coupling through

R-663, R-664, and R-665, begins to drive grid 7 negative. The cutting off of the second section of V-528 reduces the drop in common-cathode resistor R-667 and increases the positive bias on grid 2. This causes the circuit to trigger to a new stable condition with the input triode assuming full conduction while the other section becomes fully cut-off. The reverse effect occurs when the input signal swings negative, with the input section of V-528 being triggered to cut off while the other section conducts. The output potential of anode 1 for 4-channel operation will be shown in line 19 of figure 2-15 with idle spacing signals on all channels. With 6-channel operation, a signal potential pattern similar to that for channels A and B, except that pulse E3 will not be inverted, will be added to the 4-channel pattern. With 8-channel operation, two complete 4-channel patterns will be present, again with the exception of pulse F3. The pulse length will now be one-half the length of a 4-channel pulse. These patterns are coupled through isolating resistor R-668 to S-502."

2.4.10 Paragraph 3c(1)(b) should be changed to read: "The crystal-controlled oscillator circuit utilizes a pentode vacuum tube and depends upon a crystal operating at a fixed temperature for precise frequency control. The oscillator frequency of 101.25 kilocycles is used to control a series of frequency subdivider stages and one doubler stage from which appropriate frequencies are directly derived for driving the transmitting signal distributor under conditions of 4-6 or 8-channel operation. Each stage consists of an LC-tuned oscillator circuit of approximately the correct frequency, which is controlled by the injection of a signal from the preceding stage. Only one triode section is required for each stage."

2.4.11 Paragraph 3c(1)(c) should be changed to read: "One subdivider output frequency is selected by the channel switch and passed to the drive amplifier. This frequency is then converted into square waves by the squaring-amplifier circuits. These waves are differentiated, and the

resulting impulses are coupled through the output-pulse amplifier circuit to the transmitting signal distributor. When 6-channel operation is required, the the output of the 450-cycle divider, after being squared, is differentiated and used to drive a binary, frequency-divider circuit to produce the required frequency. This signal is then differentiated and applied to the output-pulse amplifier."

2.4.12 Paragraph 3c(1)(d) should be changed to read: "The frequency output of the various stages are as noted in Figure 2-25 with the following exceptions:

(1) Divider 5 is now a doubler stage, with the frequency at V-104A, pin 2, at 300 cps instead of 112.5 cps.

(2) Drive Amplifier, V-105A, pin 2, is now 150 cps at 4-channel, 225 cps at 6-channel, and 300 cps at 8-channel.

(3) Squaring Amplifier, V-106, pin 5, has the same frequencies as the drive amplifier.

(4) Binary Divider, V-107, pin 5, is now 225 cps.

(5) Output Pulse Amplifier, V-105B, pin 5, has the same frequencies as the drive amplifier.

(6) Three-channel operation is deleted.

(7) Two-channel operation is deleted."

2.4.13 Paragraph 3c(3)(b): delete all after "....a controlled frequency of 450 cycles." Insert: "This divider stage has a step-down ratio of five to one."

2.4.14 Paragraph 3c(3)(c) should be changed to read: "The output of the third divider stage (450 cps) is passed to the fourth stage, V-103B, which has

a controlled frequency of 150 cps. The fourth-stage output is used as a synchronizing signal for the doupler stage, V-104A. The output of V-104A is a controlled 300 cps. The 450-cps output of the third stage is also passed to cathode follower V-104B."

2.4.15 Paragraph 3c(4) should be deleted.

2.4.16 Paragraph 3c(5) should be changed to read: "The channel switch S-101 is operable in three positions. In the 6-channel position (old 2-channel position) as shown in revised Figure 7-44A, the 450-cycle output from the cathode follower V-104B is applied through the switch to the grid of drive amplifier V-105A. In the 8-channel (center) position, the 300-cps signal from doubler stage V-104A is applied to the grid of V-105A through another section of switch S-101. In the 4-channel switch position the 150-cps signal from fourth divider stage V-103B is applied through S-101 to the driver. V-105A is an inverting amplifier, the output of which is applied to the grid of squaring amplifier V-106. This output is also applied through isolating resistor R-153 to monitor switch S-102."

2.4.17 Paragraph 3c(6), last sentence, should be changed to read: "This connection is used only when the switch is in either the 4- or 8-channel position and connects the squaring amplifier to the output-pulse amplifier circuit. In the 6-channel position, the squaring amplifier output is applied through resistor R-139 and another section of switch S-101 to binary divider V-107."

2.4.18 Paragraph 3c(7), second sentence, should be changed to read: "It is used only when S-101 is in the 6-channel position and is then inserted between the squaring amplifier and the output amplifier circuits. In this case, 450 cps are applied from cathode follower V-104B through driver V-105A and squaring amplifier V-106 to the binary divider input. Thus, the divider output is the required 225 cycles for 6-channel operation.

2.4.19 Paragraph 3d(1)(a) should have the following sentence added: "The No 2 transmitting control monitor is not used."

2.4.20 Paragraph 3d(1)(g), first sentence, should be changed to read: "The frequency-meter circuit indicates half the frequency of the distributor driving impulses...."

2 4.21 Paragraph 3d(9)(b): add the following: "R-309 should be adjusted so that the meter indicates 150 cps with 300 cps input. The panel should be marked to indicate that meter indications are to be doubled. Thus, the indications will be 75, 112.5, and 150 cps for 4-, 6-, and 8-channels, respectively."

2.4.22 Paragraph 4a(1)(h), first sentence, should be changed to read: "The frequency meter indicates half the frequency of the distributor driving pulses."

2.4.23 Paragraph 4b(1)(c) should be changed to read: "The output drive-pulse frequencies from the receiving drive unit are identical with those obtained from the corresponding transmitting unit. Switching provides for 4-, 6-, or 8-channel operation at 60 words per minute per channel."

2.4.24 Paragraph 4b(1)(d) should be changed to read: "A potentiometer has been added in the input circuit of the squaring amplifier tube to permit adjustment of the input triggering level. This selection position control thus allows a limited advancement or retardation of the output drive pulses supplied to the receiving signal distributor. Since the corrector circuits hold the input frequency to the squaring amplifier in a fixed-phase position with the input multiplex signal elements, adjustment of the control permits orientation of the distributor circuits to obtain the greatest detecting margins. The corrector circuits are energized from the output of the squaring amplifier circuit itself when six channels are being used. This causes the control to be effective only under 4- or 8-channel operating conditions. It is usually adjusted for optimum margin in 8-channel service so that 4-channel operation normally follows."

2.4.25 Paragraph 4b(1)(e) should be changed to read: "The output of the drive amplifier is also applied to a second squaring amplifier circuit, which is part of the corrector circuit in 4- and 8-channel operation. The corrector squaring amplifier likewise has a potentiometer on its input circuit, which is used in this case to obtain a perfect symmetry in the output square waves. These signals in normal and inverted form are applied to a section of the channel number switch not previously used. The same type signals from the binary divider circuit are also applied to this switch section for use in 6-channel correction."

2.4.26 Paragraph 4b(3) should be changed to read: "The corrector squaring amplifier tube, V-108, Type 6SN7 is connected as a regenerative triggering amplifier similar to circuits previously described. Through adjustment of its input circuit control, R-155, it is made to slice exactly on the neutral axis of the applied signals. The two sections then alternate between conduction and cut-off for successive half cycles of input. Output signals which are exactly 180 degrees out of phase, relative to each other, are taken from the two anodes of V-108 and applied through S-104 to the fast and slow gate tubes, V-110 and V-109, respectively. These connections are made for both 4- and 8-channel operation. In the 6-channel condition, S-104 bypasses V-108 and applies two out-of-phase signals developed in the binary frequency divider, V-107, to the output circuits."

2.4.27 Paragraph 4b(4) should be changed to read: "The correction pulse width control tube, V-111, Type 6SN7, is connected as a unibrator similar to circuits previously described. It is excited by negative impulses from the receiving control monitor unit, applied through terminal C of J-104 and C-135, and causes the other section to conduct for about 0.001 second, as determined by the time constant of the grid circuit components. The circuit then relaxes to its original condition with the input section conducting. The input section anode potential waveform, consisting of a rectangular positive impulse, is divided through resistors R-170 and R-171 and applied through C-138 and R-174 to the grid circuits of V-109A and V-110A."

2.4.28 Add paragraph 4b(9) to read as follows: "The receivin utor drive in Unit No. 2 is not used."

2.4.29 Paragraph 4c(1)(e) should be changed to read: "The N receiving signal distributors each have 12 double-triode tubes a groups to provide the matrices in which the signal pattern is de sponding sections of one group in the No. 1 receiving signal dis modate A and B channels, while like sections of the second grou C and D channels. One group in the No. 2 receiving signal dist modates E and F channels, and the other accommodates G and H matrix triode is controlled from three sources, the impulse dis channel distributor, and a matrix-keyer triode in the receiving unit. Two keyer triodes each supply anode potentials to a group in accordance with the signal polarity produced by the correspon in the transmitting signal distributors. One keyer triode thus a multiplex signals to the first, fifth, and sixth matrix triodes on B channel; the first, third, fifth, and sixth matrix triodes on E of F channel. The other keyer triode applies inverted multiplex remaining matrix tube sections. Each matrix triode will be pre duction only when its anode potential is positive, or marking, in its group polarity. The matrix tubes are primed in channel grou channel distributor and are then energized by impulses from the tributor. The simultaneous application of proper potentials caus of a positive output impulse which indicates a marking signal ele Each selection impulse is passed to the proper receiving telegra where it is used to fire a corresponding gas selector tube."

2.4.30 Paragraph 4c(6): add the following: "The drive pulse a matic starting, impulse distributor, drive pulse relay, and chan fier circuits are not used in the No. 2 receiving signal distributo are provided by the No. 1 receiving signal distributor unit."

2.4.31 Paragraph 4c(7) should be changed to read: "This channel distributor circuit is identical with the corresponding circuit of the transmitting signal distributor described in paragraph 3b(6). Its outputs are directed through resistor networks to the matrix groups of tubes. To provide a stronger pulse to the first matrix tube in each of the eight matrix circuits, the signal input from the channel distributor to these first tubes is brought out in a different manner and the biasing on these tubes is changed. See Fig. 7-48A. The channel distributor also supplies operating impulses to the receiving telegraph code converters. The common anode voltage for the E-, F-, G-, and H-channel distributor tubes in the No. 2 receiving signal distributor is supplied from the same resistor as the A-, B-, C-, and D-channel distributor tubes in No. 1 receiving signal distributor. The drive pulses are also provided by the No. 1 receiving signal distributor for the channel distributor tubes in the No. 2 receiving signal distributor unit. The monitor connection extends through R-546 and C-523 to S-503. Distributor cycle indicator lamp I-501 is again used. Channel switch S-501 in the No. 1 receiving signal distributor is not used. Channel switch S-501 in the No. 2 receiving signal distributor is used to reduce from 8- to 6-channel operation only."

2.4.32 Paragraph 4c(8) (a) should be changed to read: "The matrix circuits are comprised of matrix tubes V-533 to V-544, inclusive, in No. 1 and No. 2 receiving signal distributors, all types 12AU7, and all connected as cathode followers The A- and E-channel connections are made from the A sections of V-533 and V-538, inclusive. The B- and F-channel connections are made from the B sections of the same tubes. C, D, G, and H channels are connected to corresponding sections of V-539 to V-544, inclusive. Normal input multiplex signals of plus 90 volts for marking or of ground potential for spacing signals elements are applied to the anodes of V-533, V-534B, V-535B, V-536B, B-537, and V-538 of the No. 1 receiving signal distributor unit and V-533, V-534B, V-535, V-536B, V-537, and V-538 of the No. 2 receiving signal distributor unit from the distributor

matrix keyer in the No. 1 receiving control monitor, via terminal C of J-507. Signals inverted from these, but of the same magnitudes and from the same source, are applied to the anodes of V-534A, V-535A, V-536A, and V-539 to V-544 in the No. 1 receiving signal distributor and V-534A, V-536A, and V-539 to V-544 in the No. 2 receiving signal distributor through terminal E of J-507. The matrix tubes can conduct only when the positive anode potentials are applied."

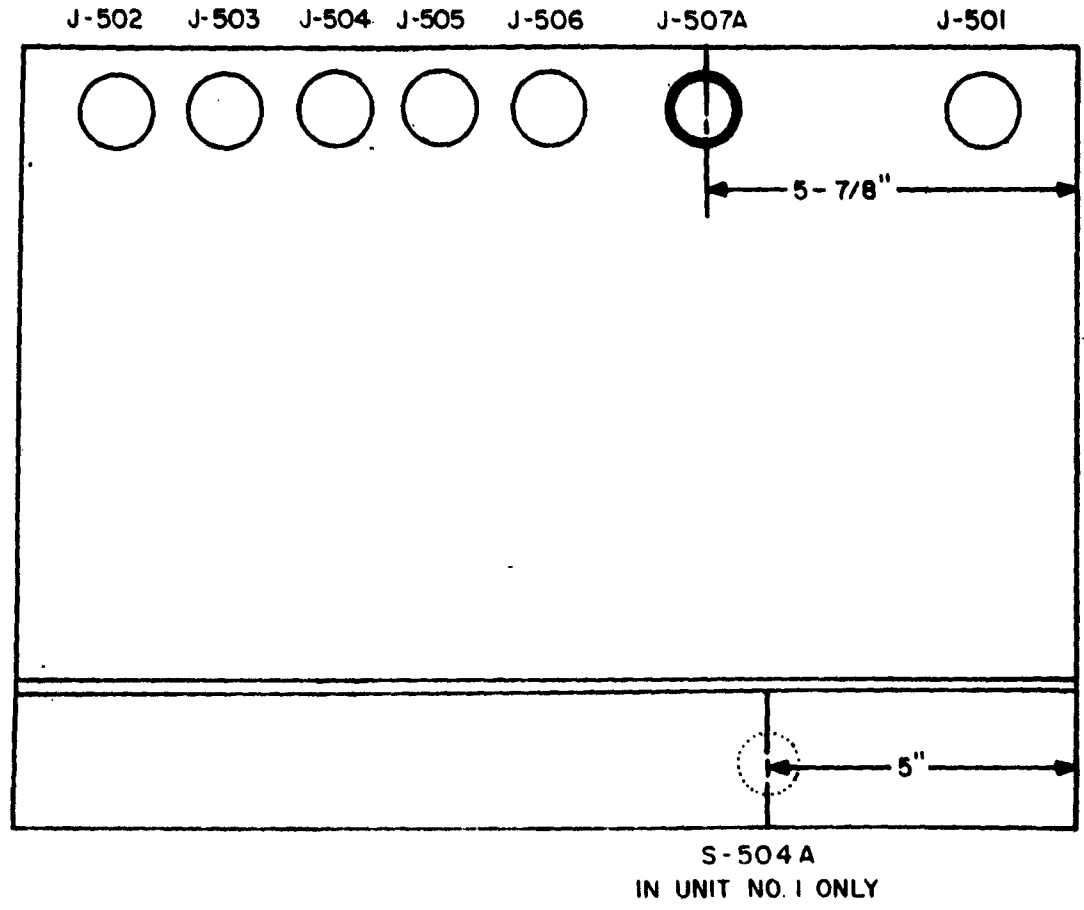


Figure 2-1 Transmitting Signal Distributor, Plug Locations

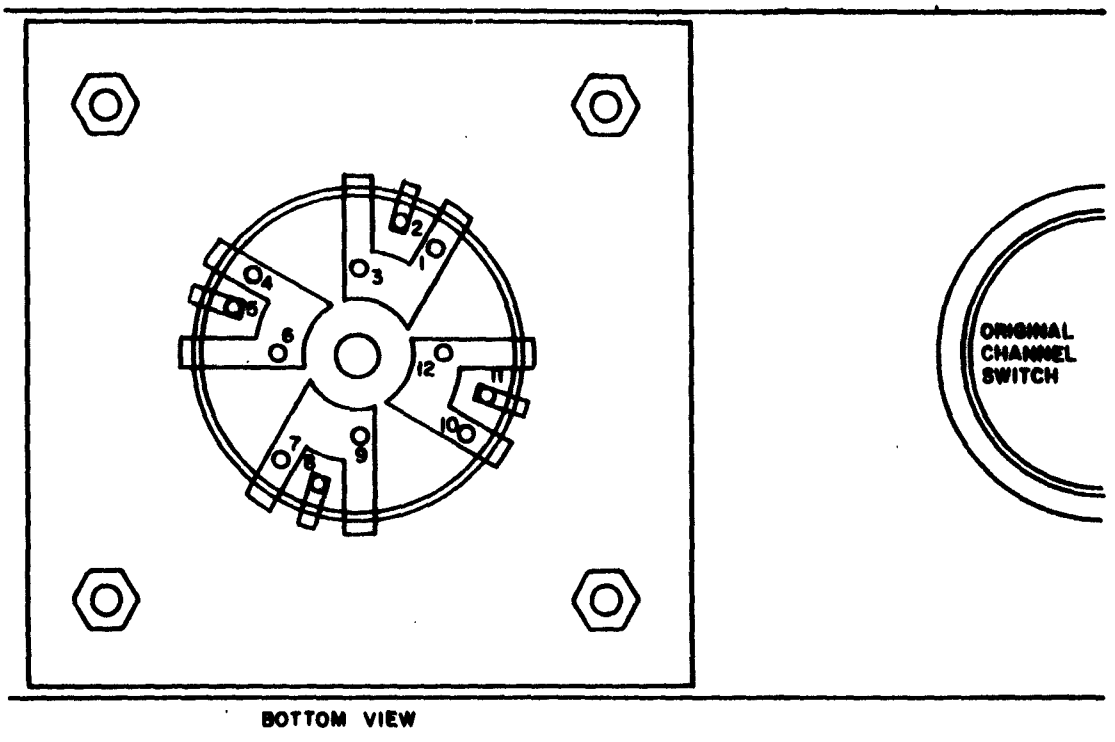


Figure 2-2 Signal Distributor Location Of New Channel Switch, S-504A and S-506A

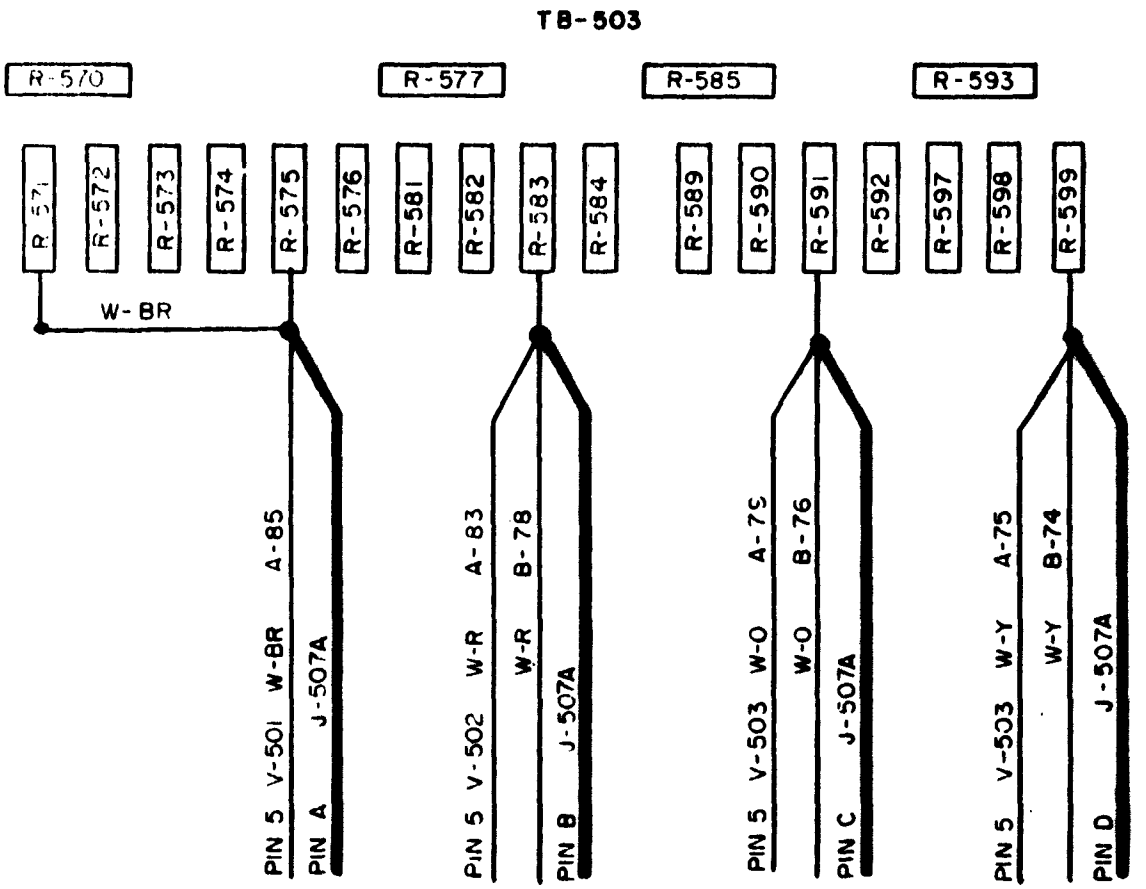


Figure 2-3 Transmitting Signal Distributor, Unit No. 1, TB-503 (Part 1)

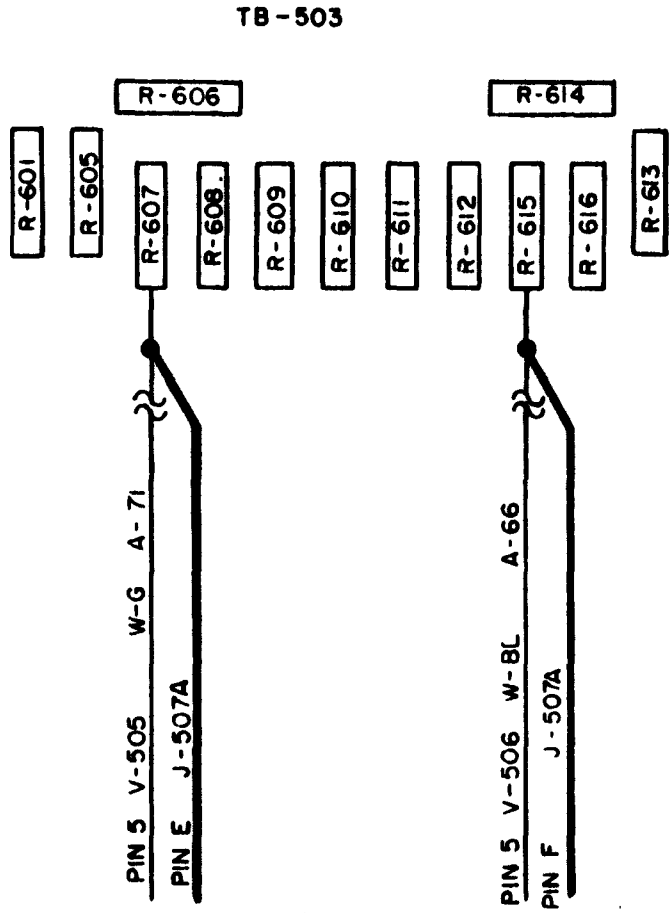


Figure 2-4 Transmitting Signal Distributor, Unit No. 1, TB-503 (Part 2)

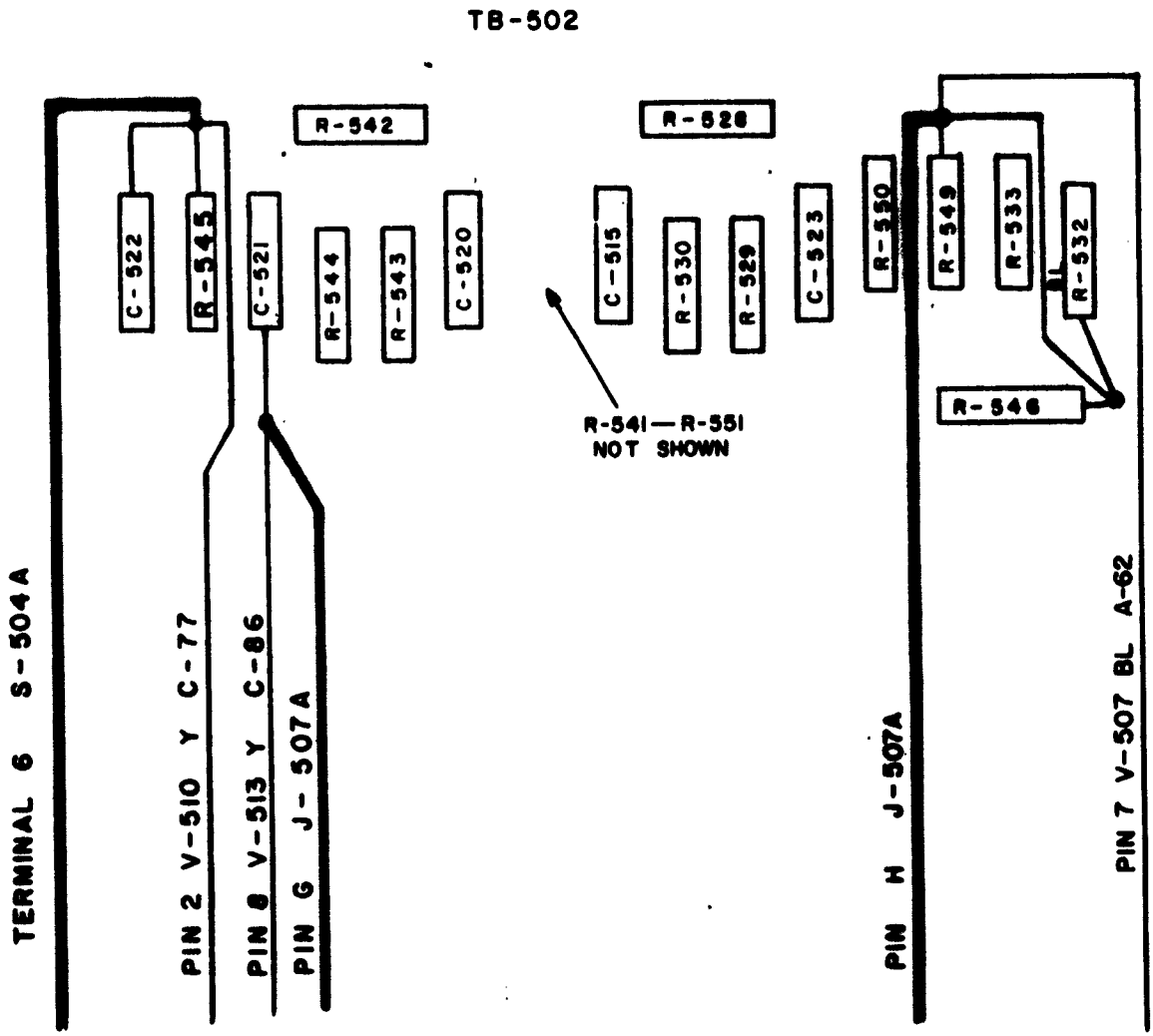
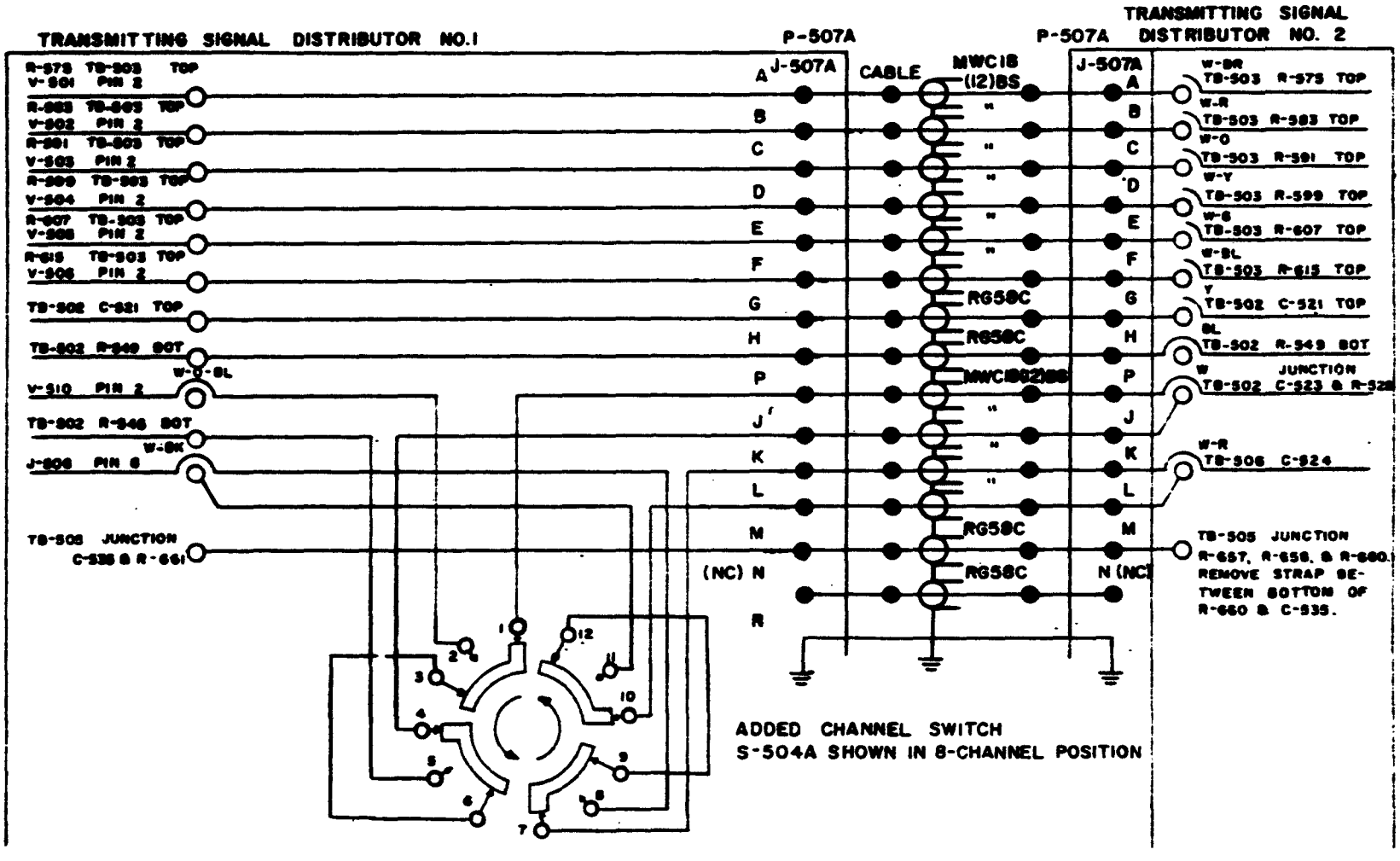


Figure 2-5. Transmitting Signal Distributor, Unit No. 1, TB-502



NOTE:
IN NO. 2 DISTRIBUTOR, WHERE WIRE IS SHOWN REMOVED FROM TERMINAL, TAPE. IF THERE ARE 2 WIRES ON THE TERMINAL, REMOVE & TAPE THE WIRE THAT GOES INTO THE LACED FORM.

Figure 2-6 Transmitting Signal Distributors, Interconnection Diagram

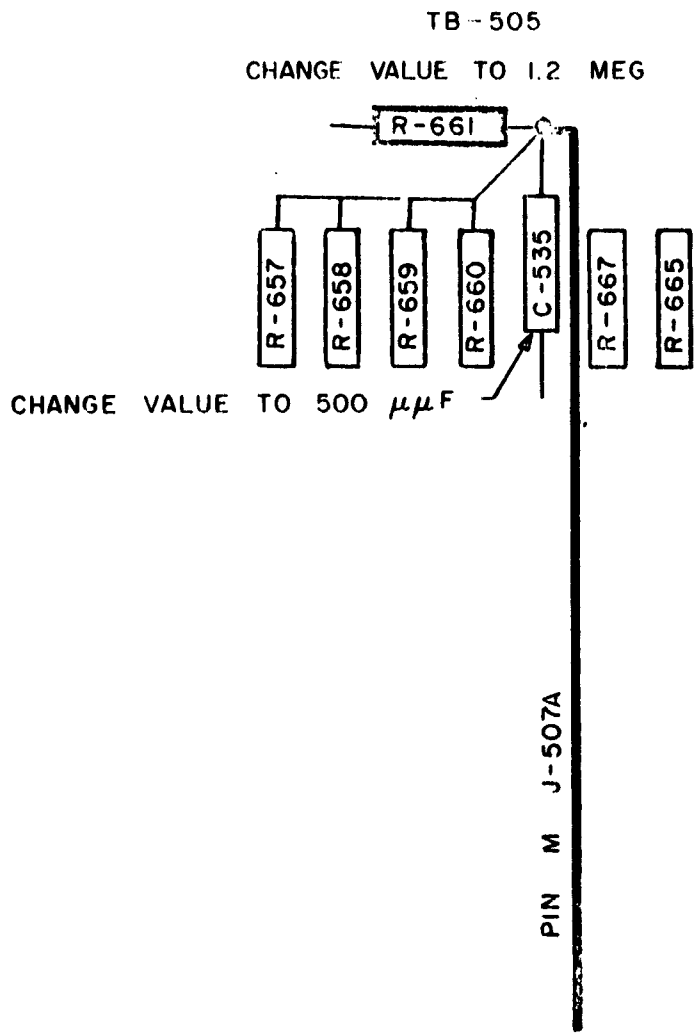


Figure 2-7 Transmitting Signal Distributor, Unit No. 1, TB-505

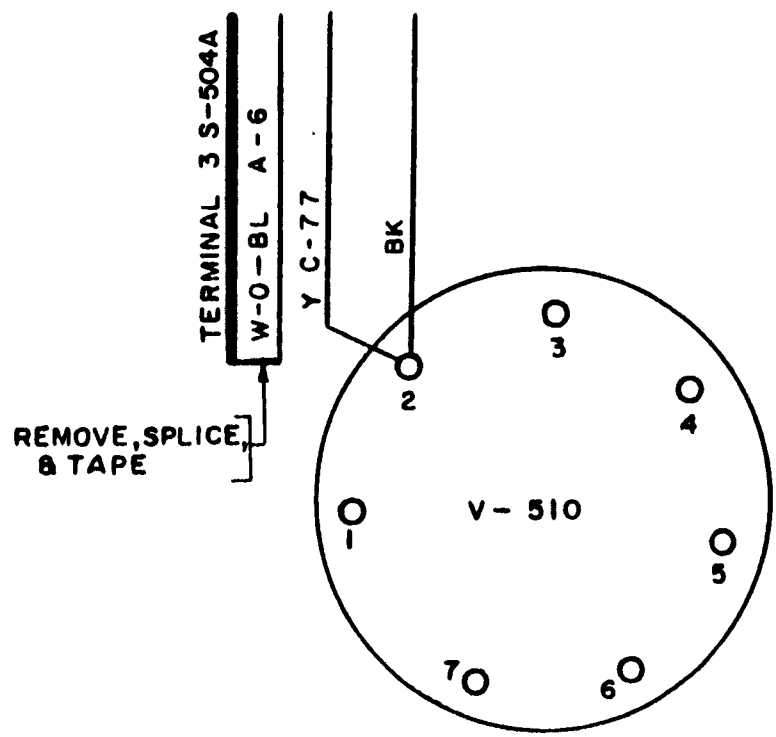


Figure 2-8 Transmitting Signal Distributor, Unit No. 1, V-510

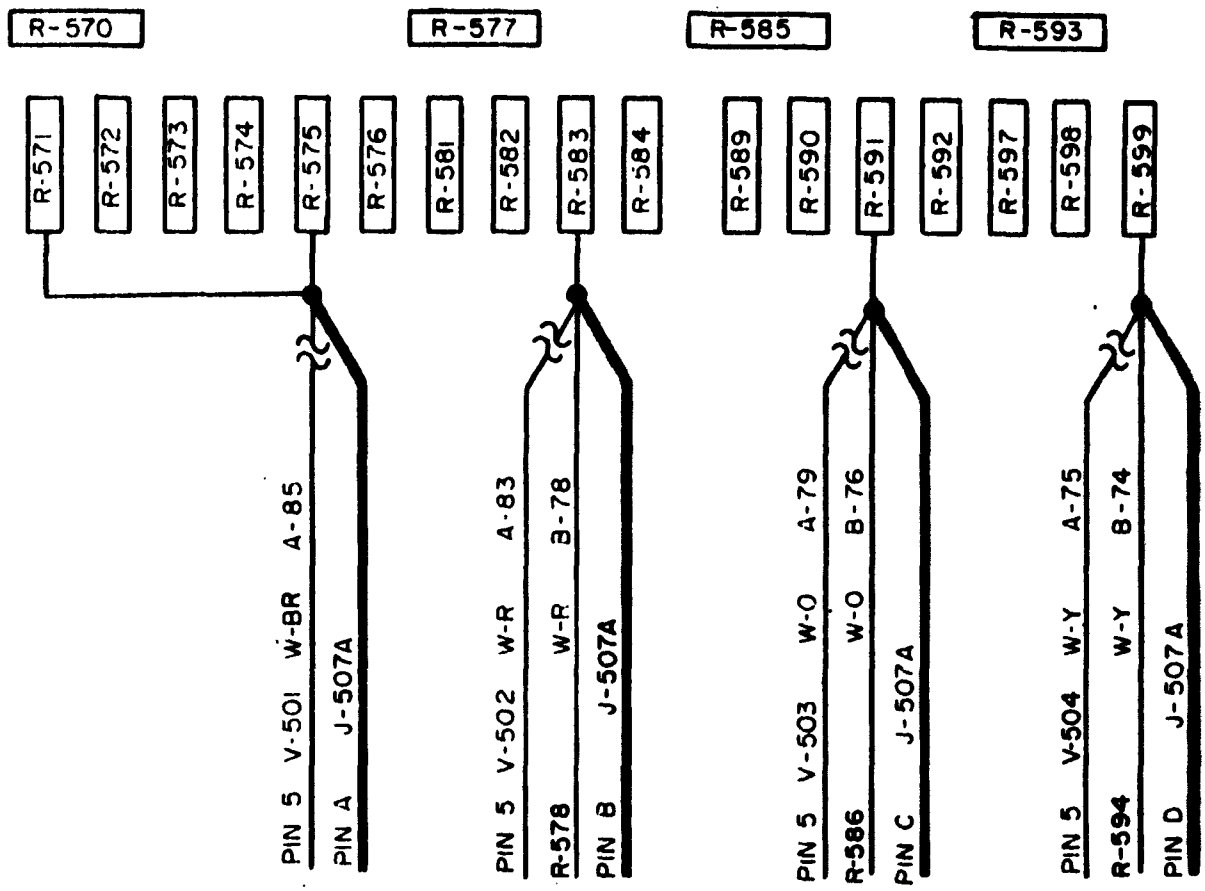


Figure 2-9 Transmitting Signal Distributor, Unit No. 2, TB-503 (Part 1)

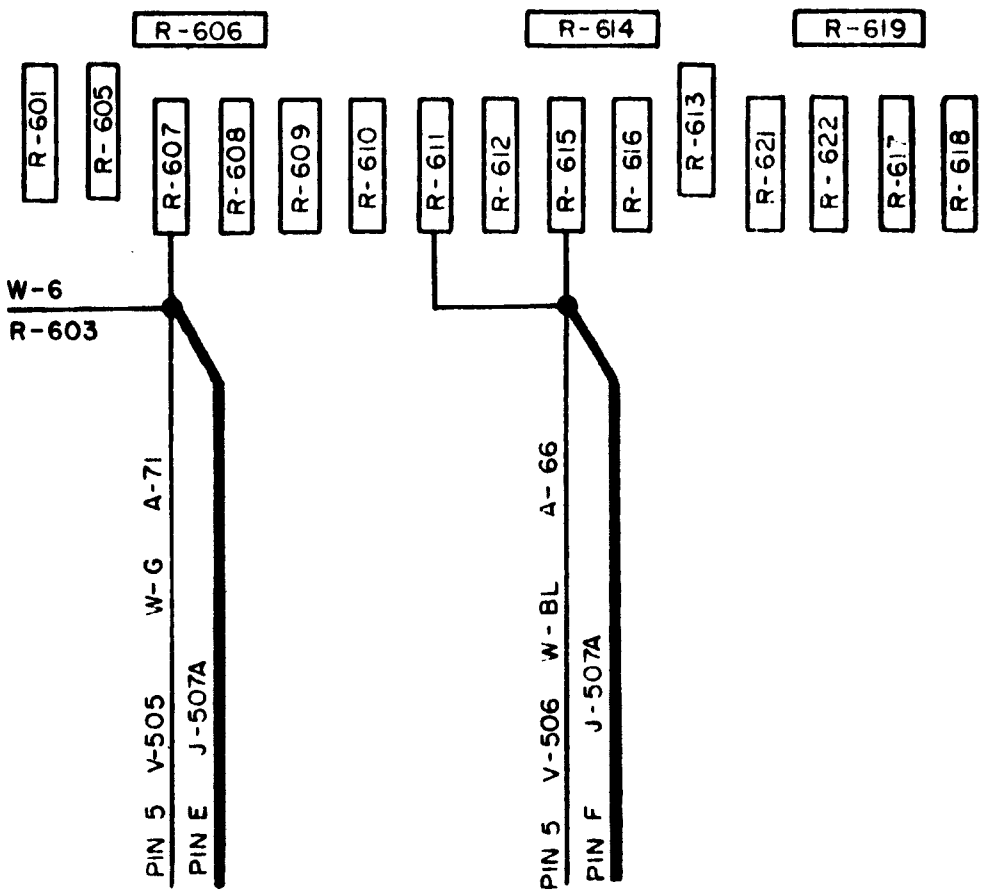


Figure 2-10 Transmitting Signal Distributor, Unit No. 2, TB-503 (Part 2)

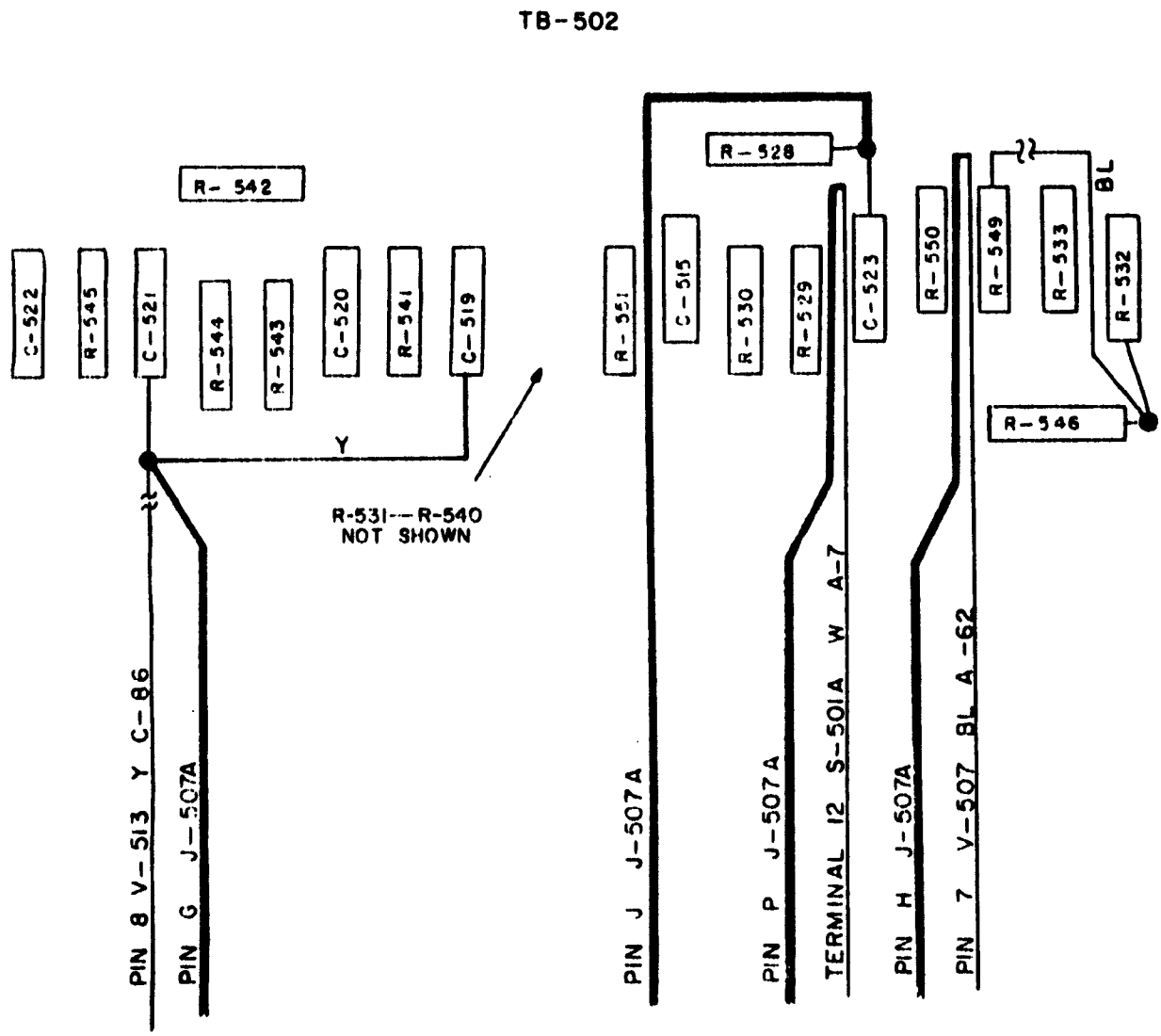


Figure 2-11 Transmitting Signal Distributor, Unit No. 2, TB-502

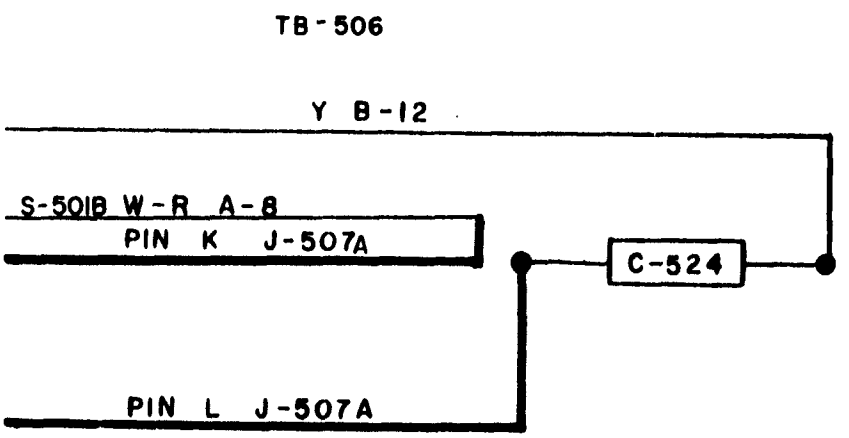


Figure 2-12 Transmitting Signal Distributor, Unit No. 2, TB-506

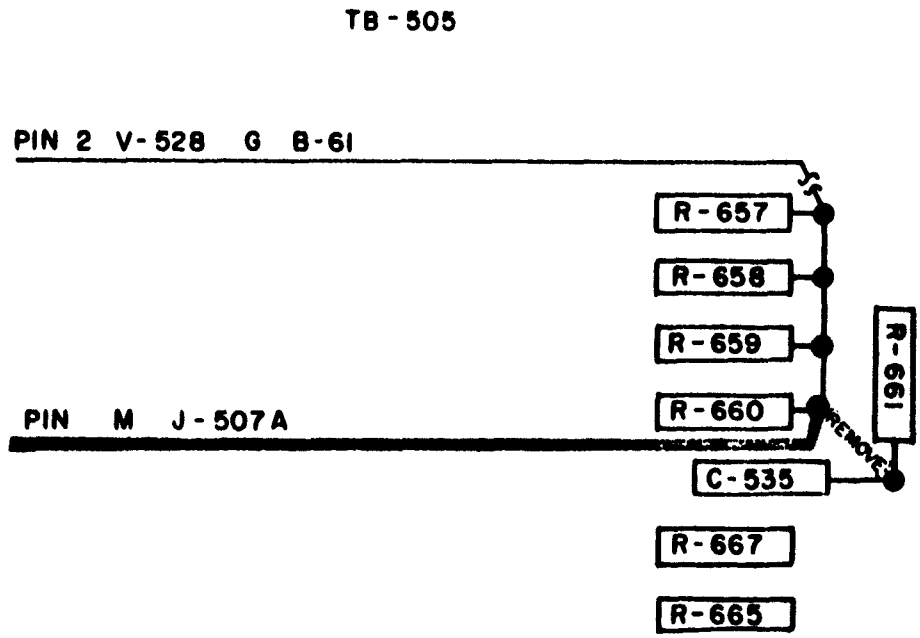


Figure 2-13 Transmitting Signal Distributor, Unit No. 2, TB-505

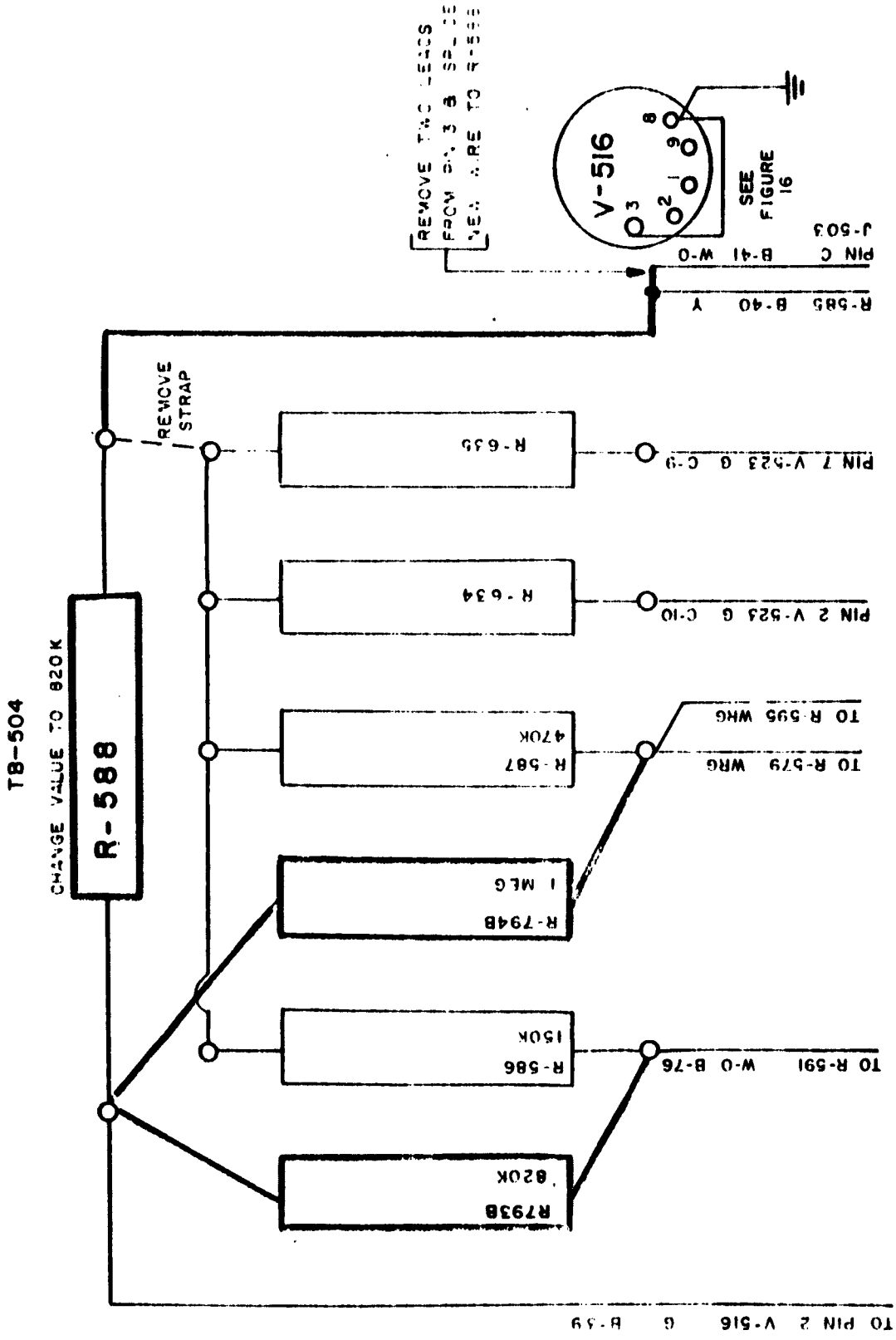
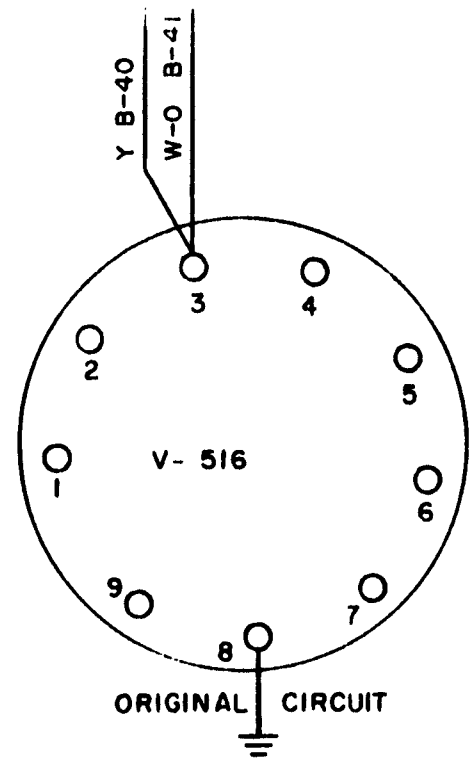


Figure 2-14 Transmitting Signal Distributor, Unit No. 2, TB-504



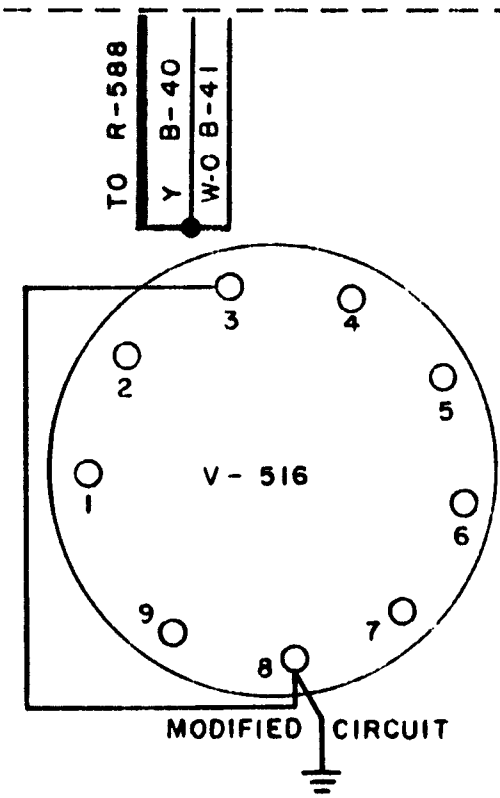


Figure 2-15 Transmitting Signal Distributor, Unit No. 2, V-516

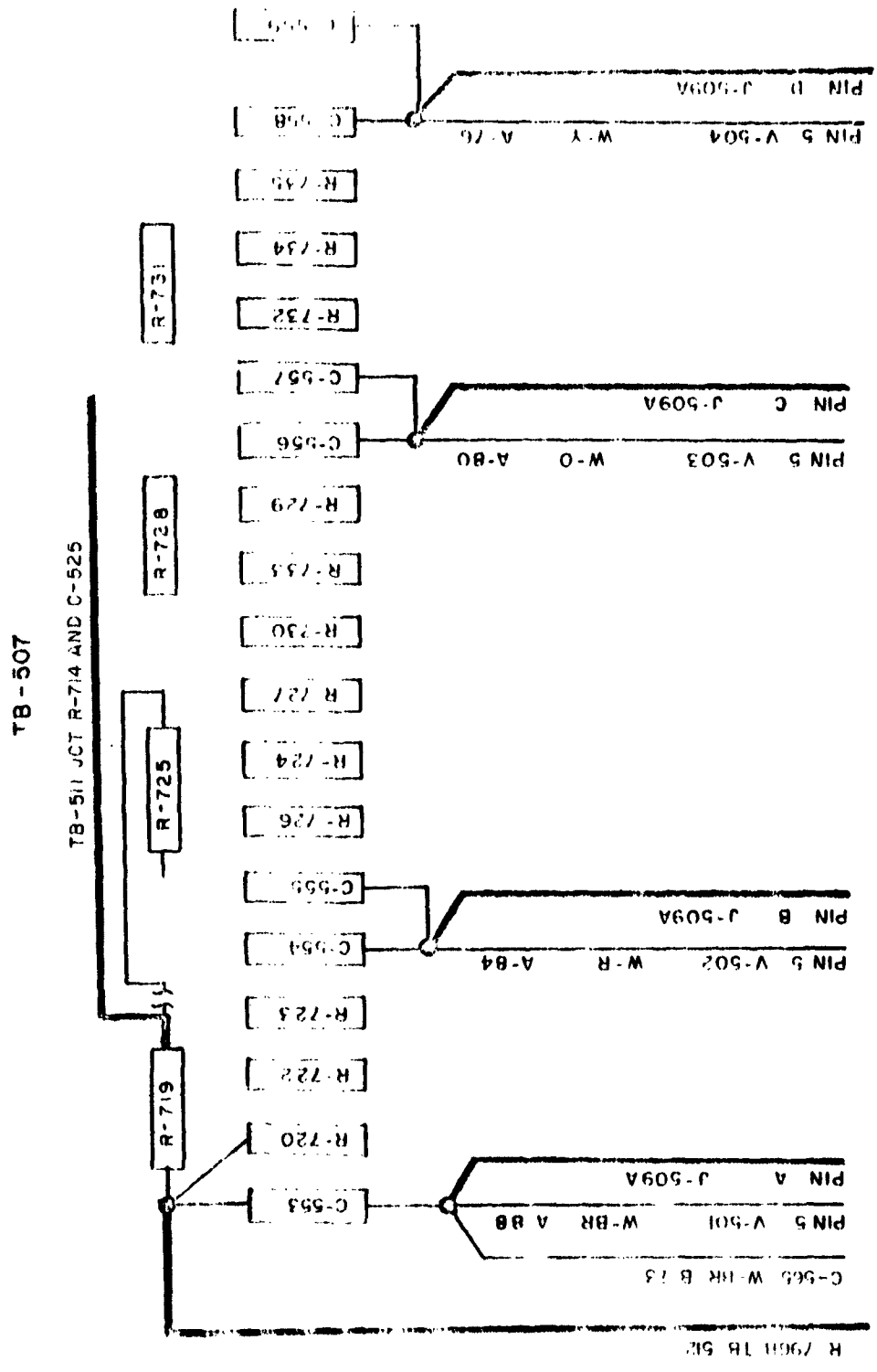
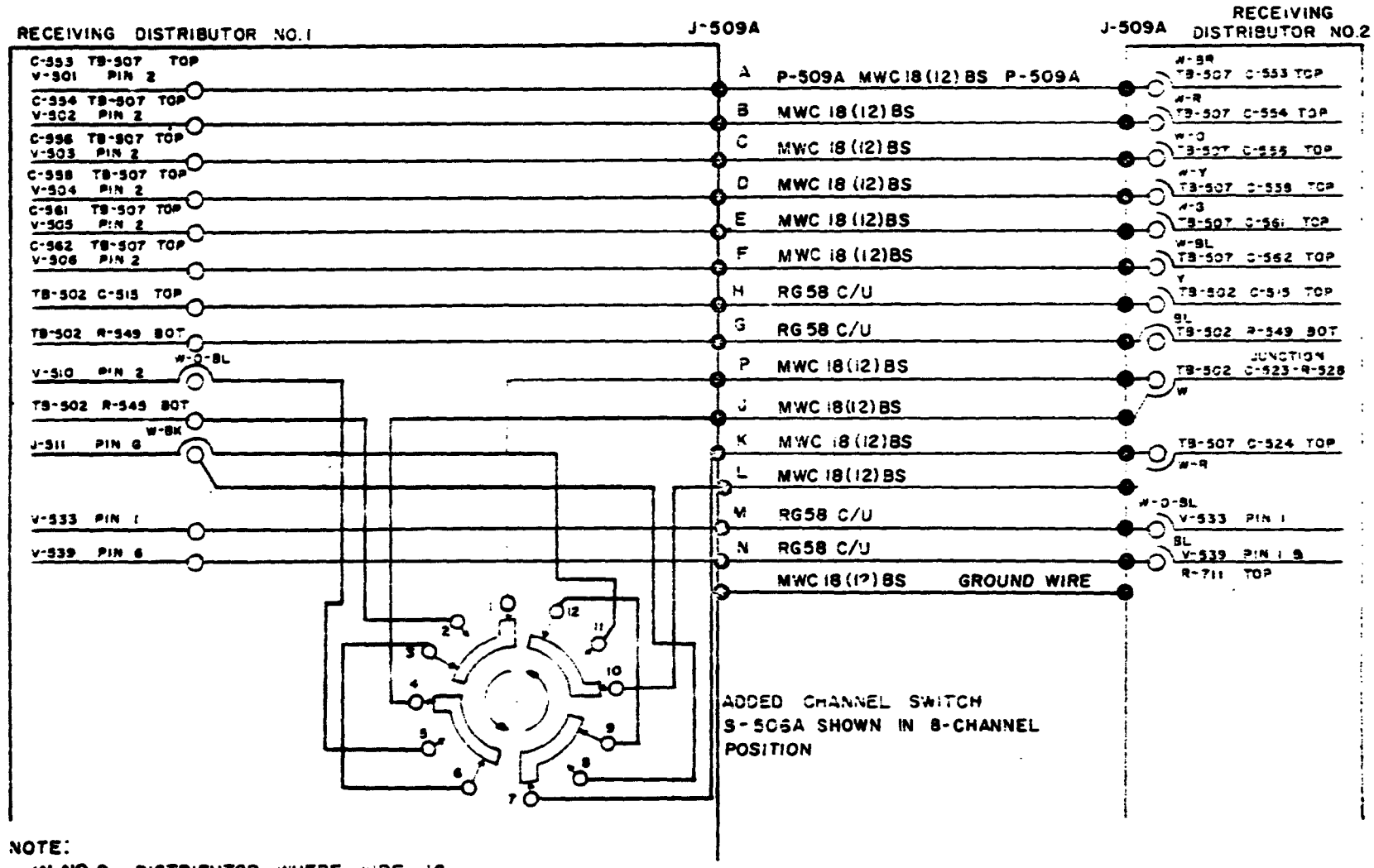


Figure 2-16 Receiving Signal Distributor, Unit No. 1, TB-507 (Part 1)



NOTE:
IN NO. 2 DISTRIBUTOR, WHERE WIRE IS SHOWN REMOVED FROM TERMINAL, TAPE. IF THERE ARE 2 WIRES ON THE TERMINAL, REMOVE & TAPE THE WIRE THAT GOES INTO THE LACED FORM.

Figure 2-17 Receiving Distributors, Interconnection Diagram

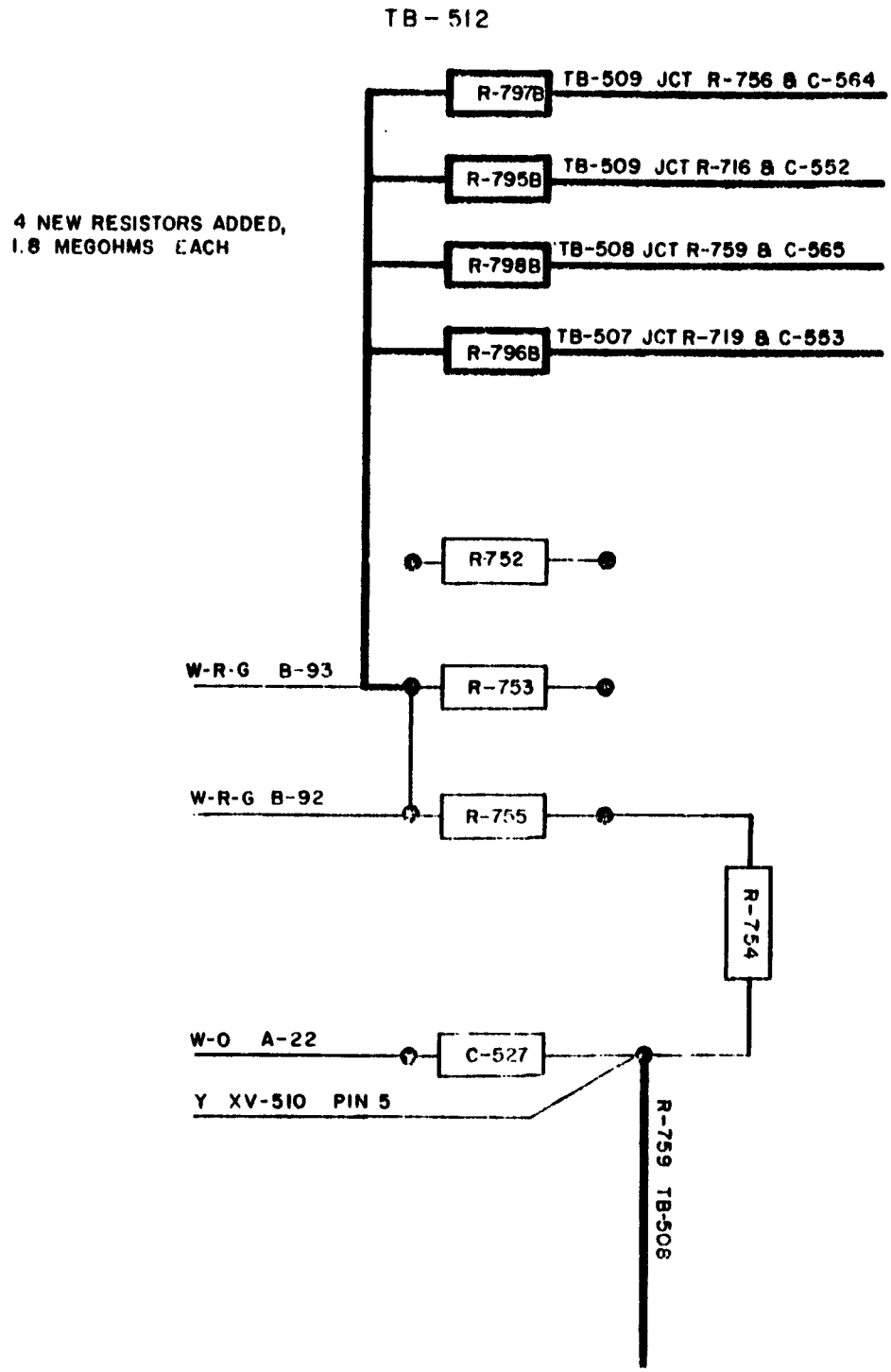


Figure 2-18 Receiving Signal Distributors, Units No. 1 and 2, TB-512

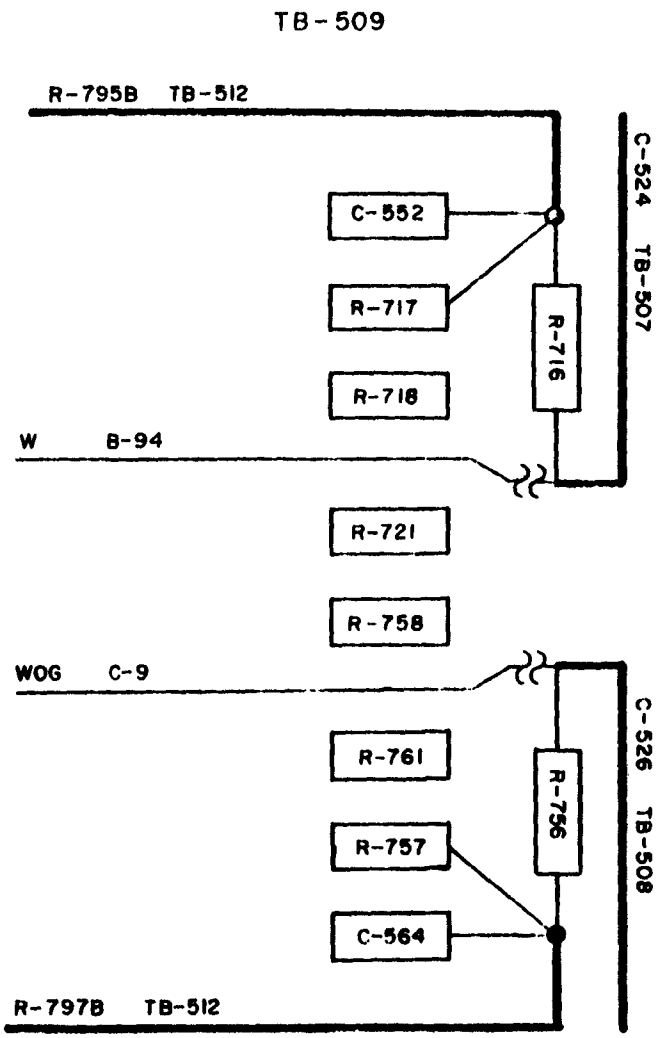


Figure 2-19 Receiving Signal Distributors, Units No. 1 and 2, TB-509

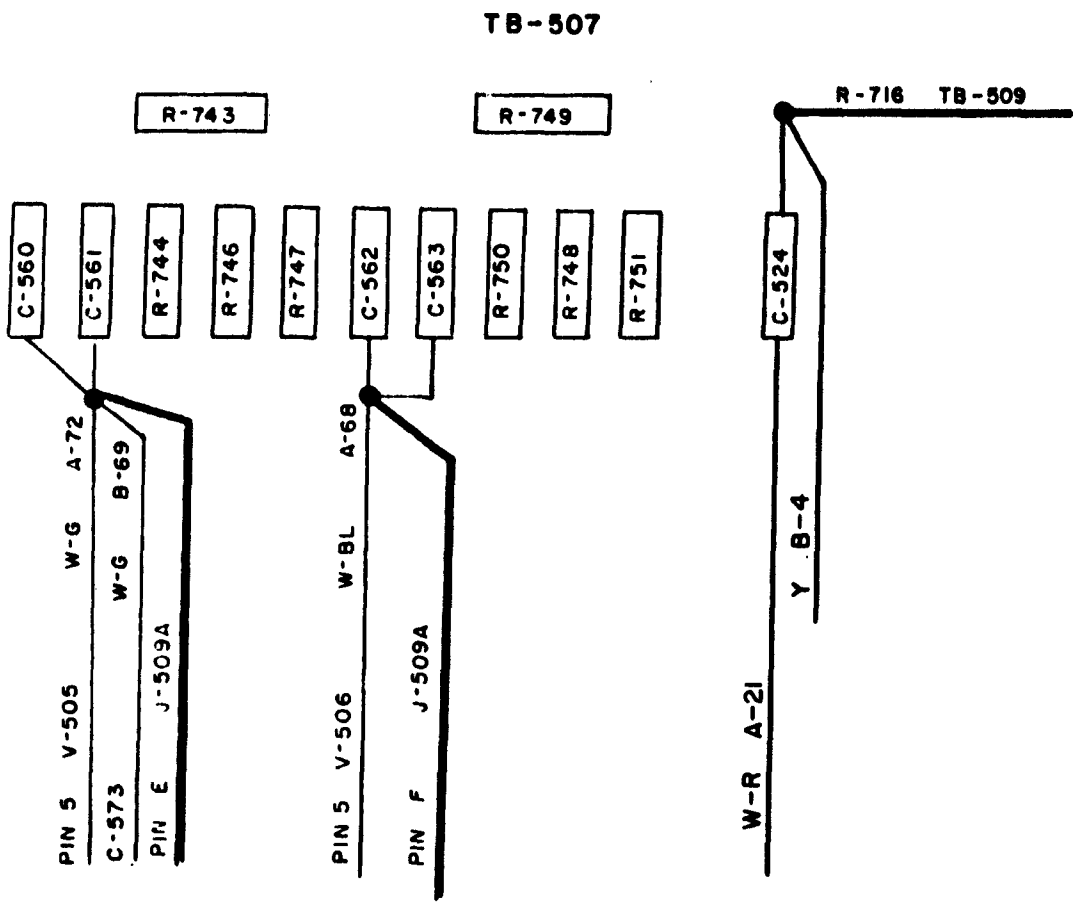


Figure 2-20 Receiving Signal Distributor, Unit No. 1, TB-507 (Part 2)

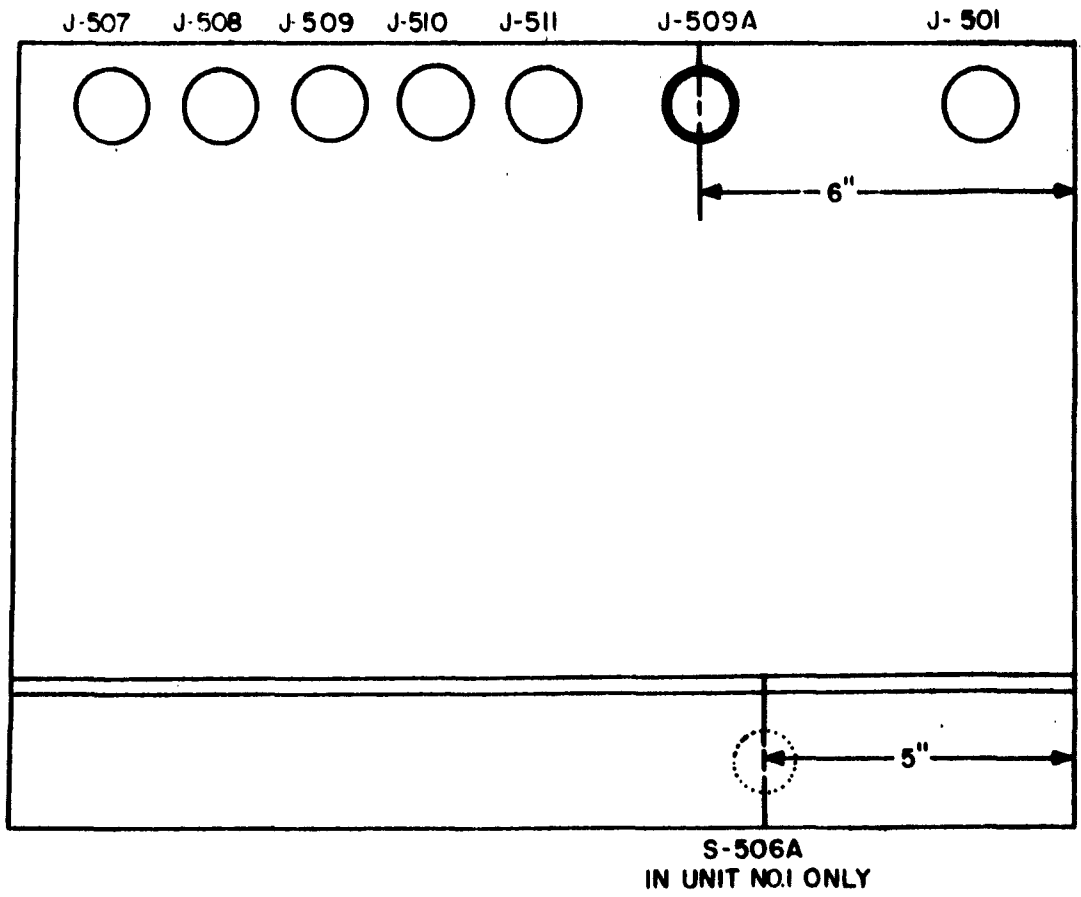


Figure 2-21 Receiving Signal Distributor, Plug Locations

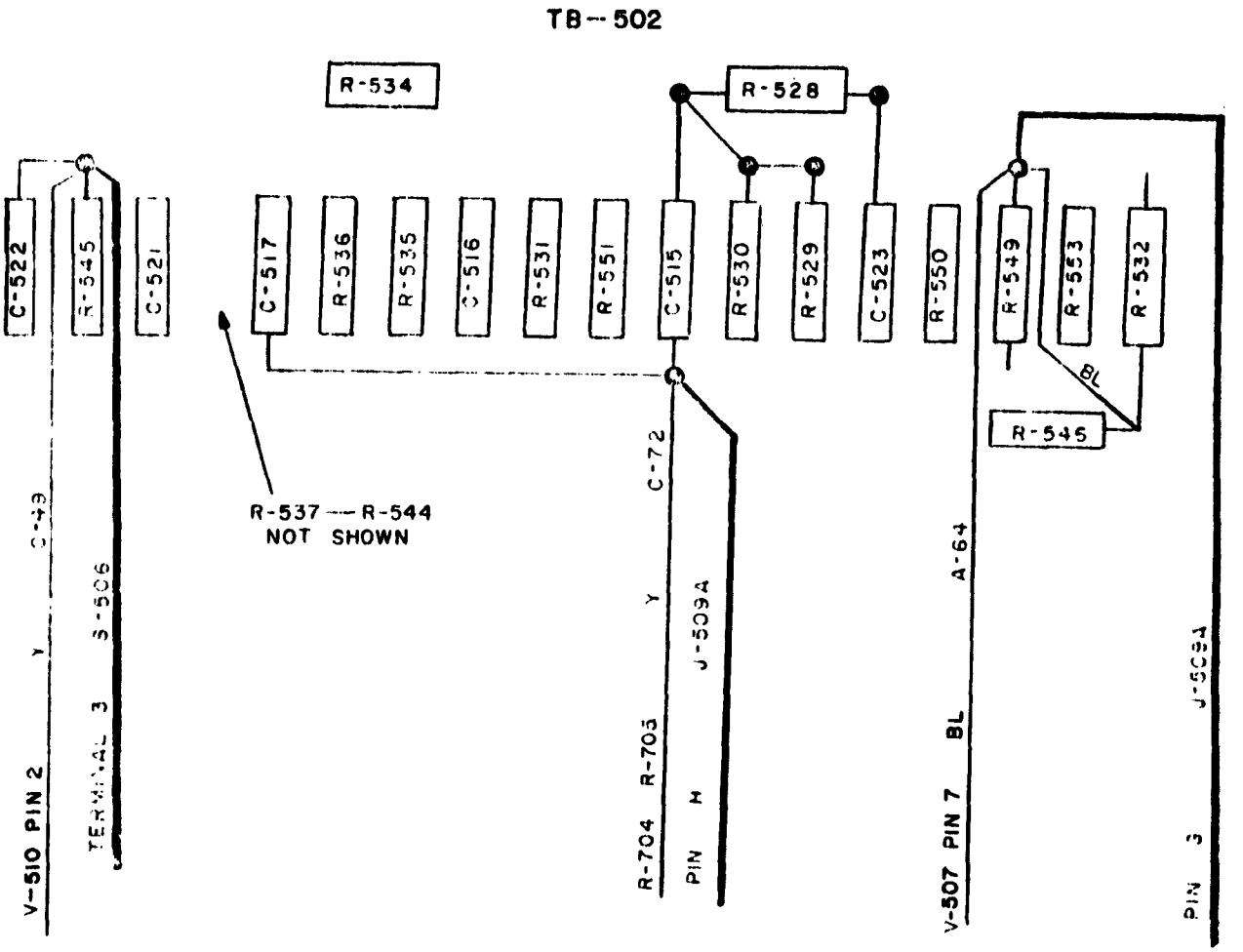


Figure 2-22 Receiver Signal Distributor, Unit No. 1, TB-502

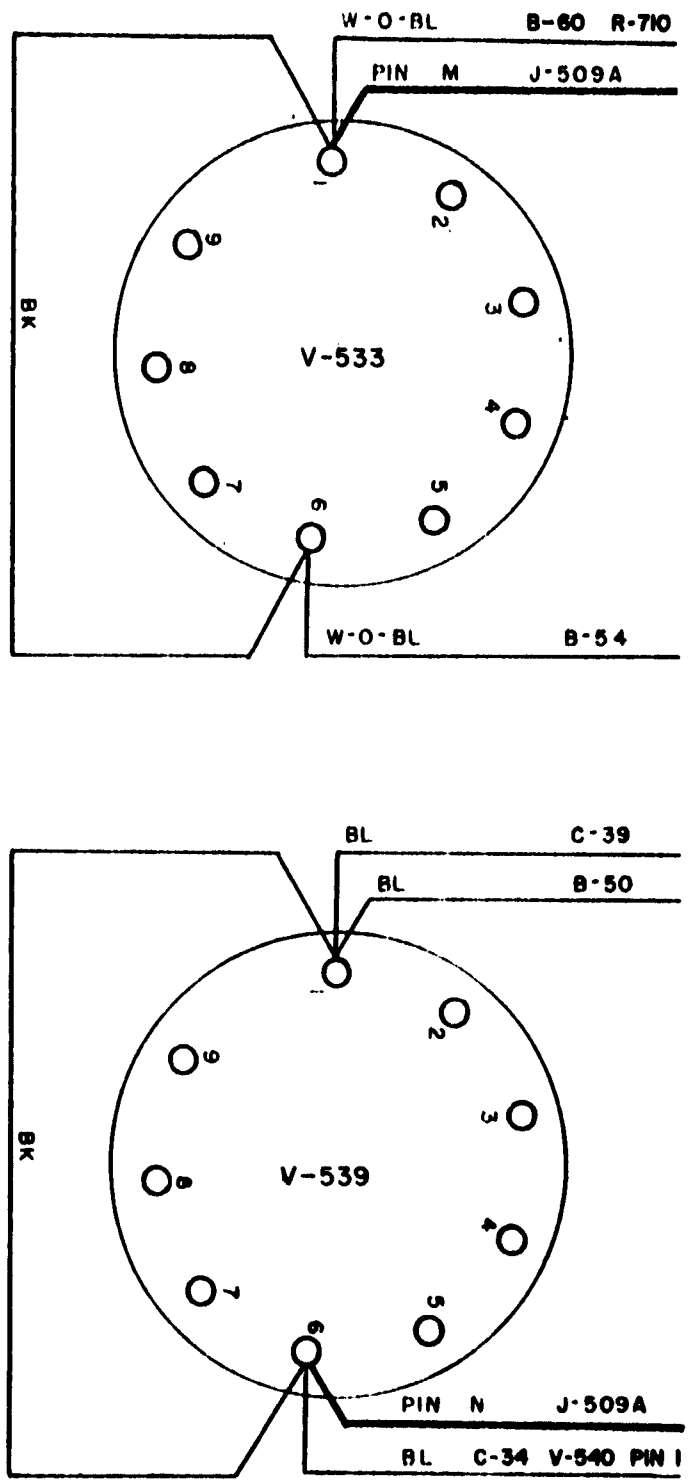


Figure 2-23 Receiving Signal Distributor, Unit No. 1, V-533 and V-539

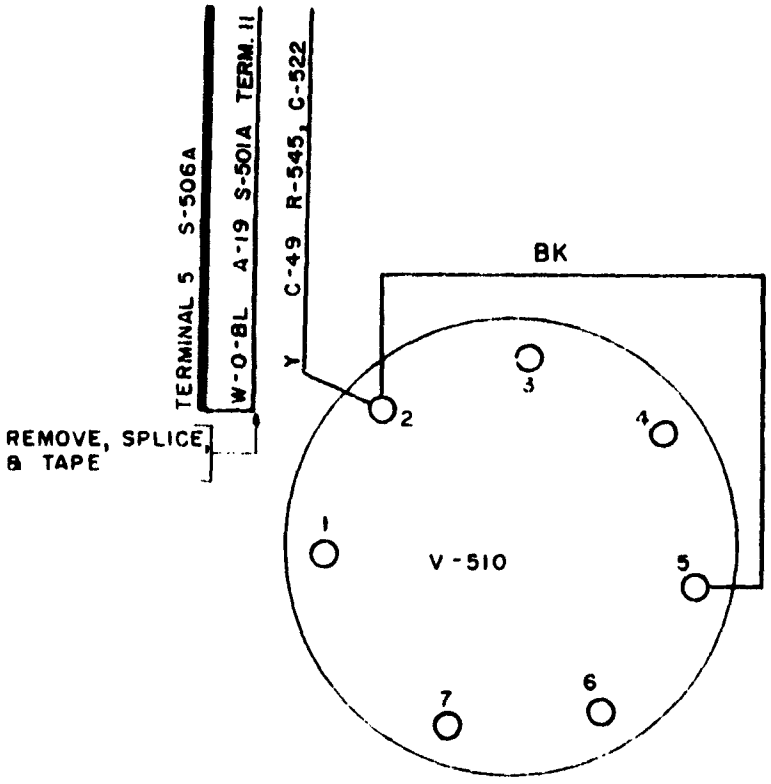


Figure 2-24 Receiving Signal Distributor, Unit No. 1, V-510

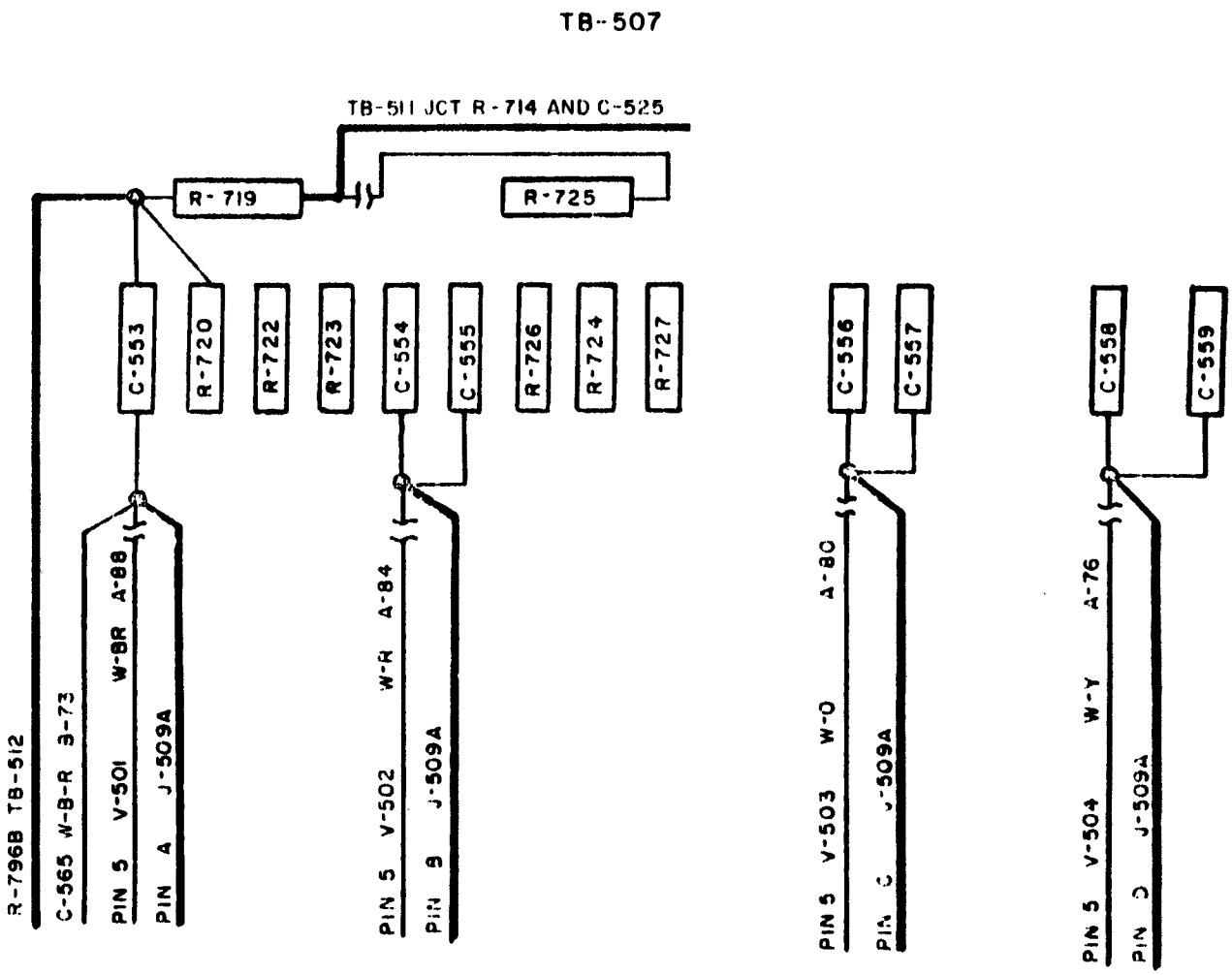


Figure 2-25 Receiving Signal Distributor, Unit No. 2, TB-507 (Part 1)

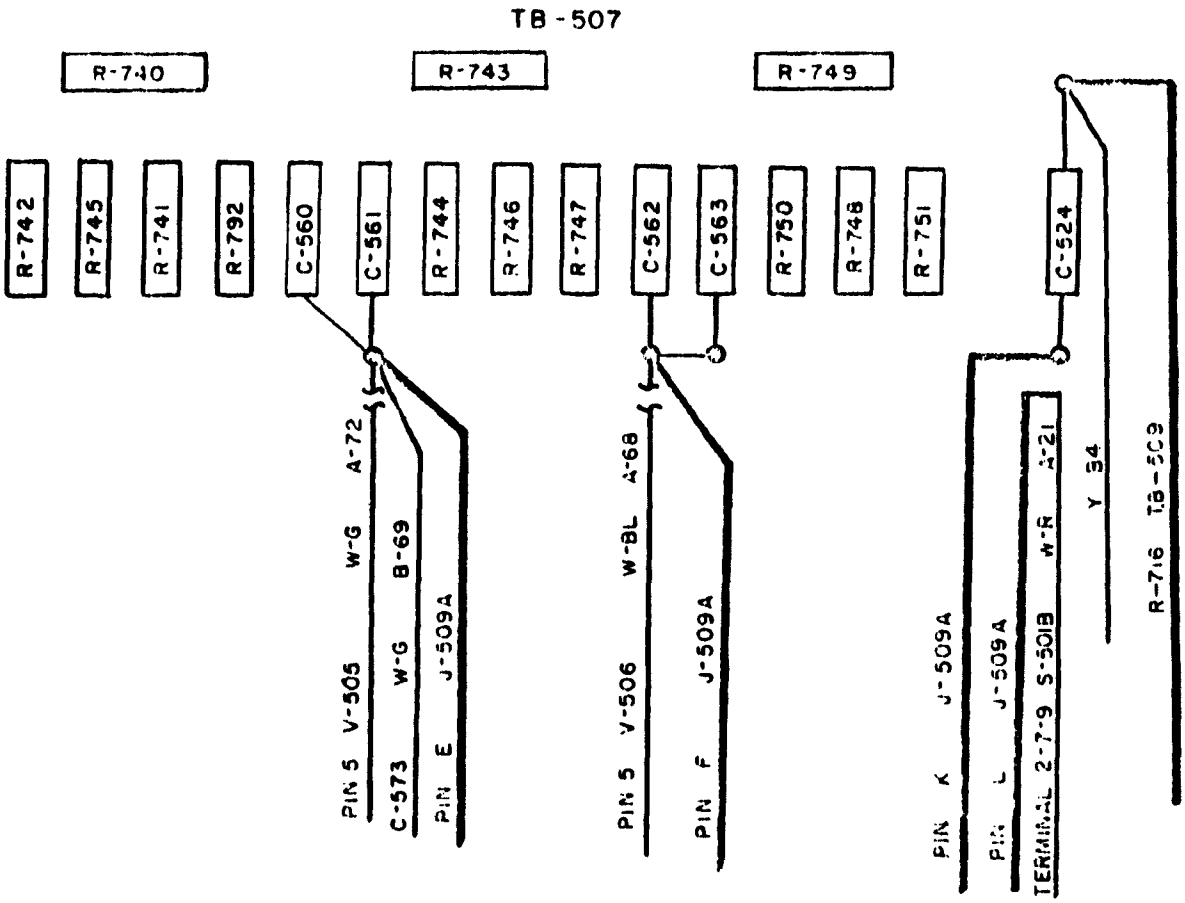


Figure 2-26 Receiving Signal Distributor, Unit No. 2, TB-507 (Part 2)

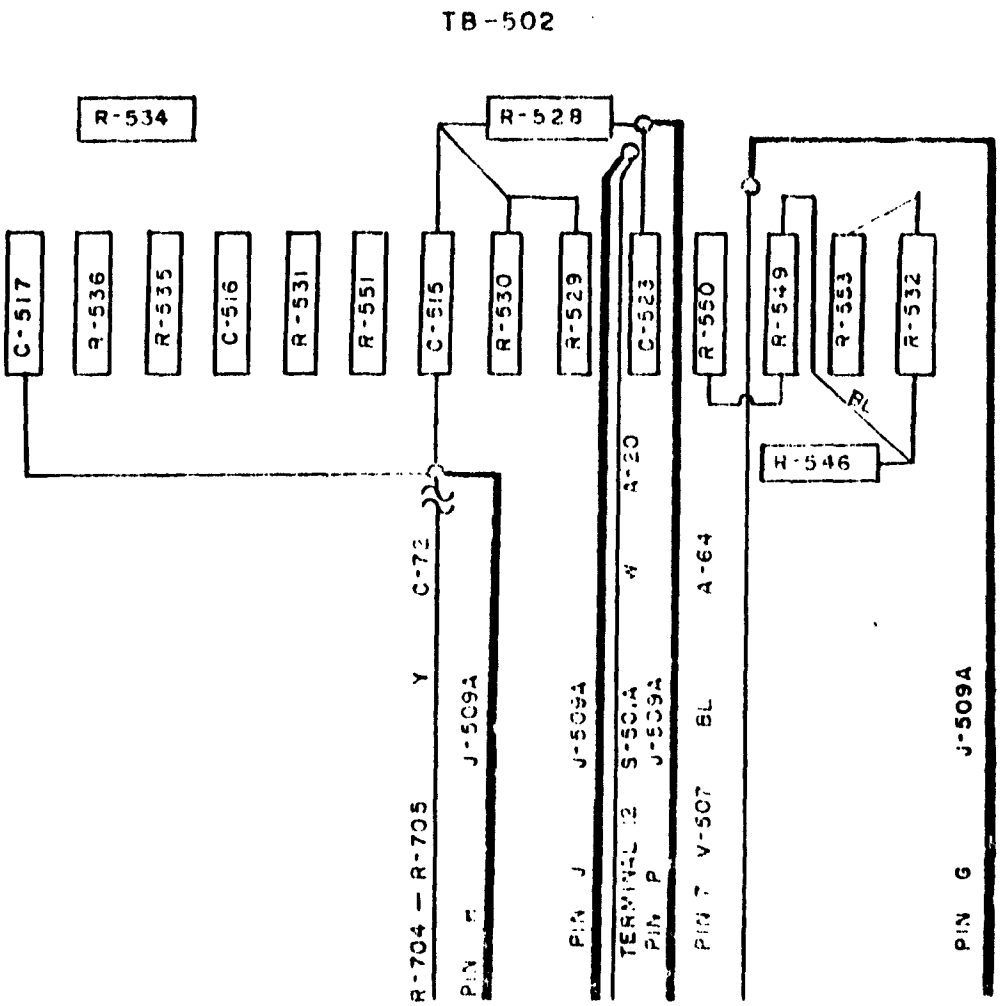


Figure 2-27 Receiving Signal Distributor, Unit No. 2, TB-502

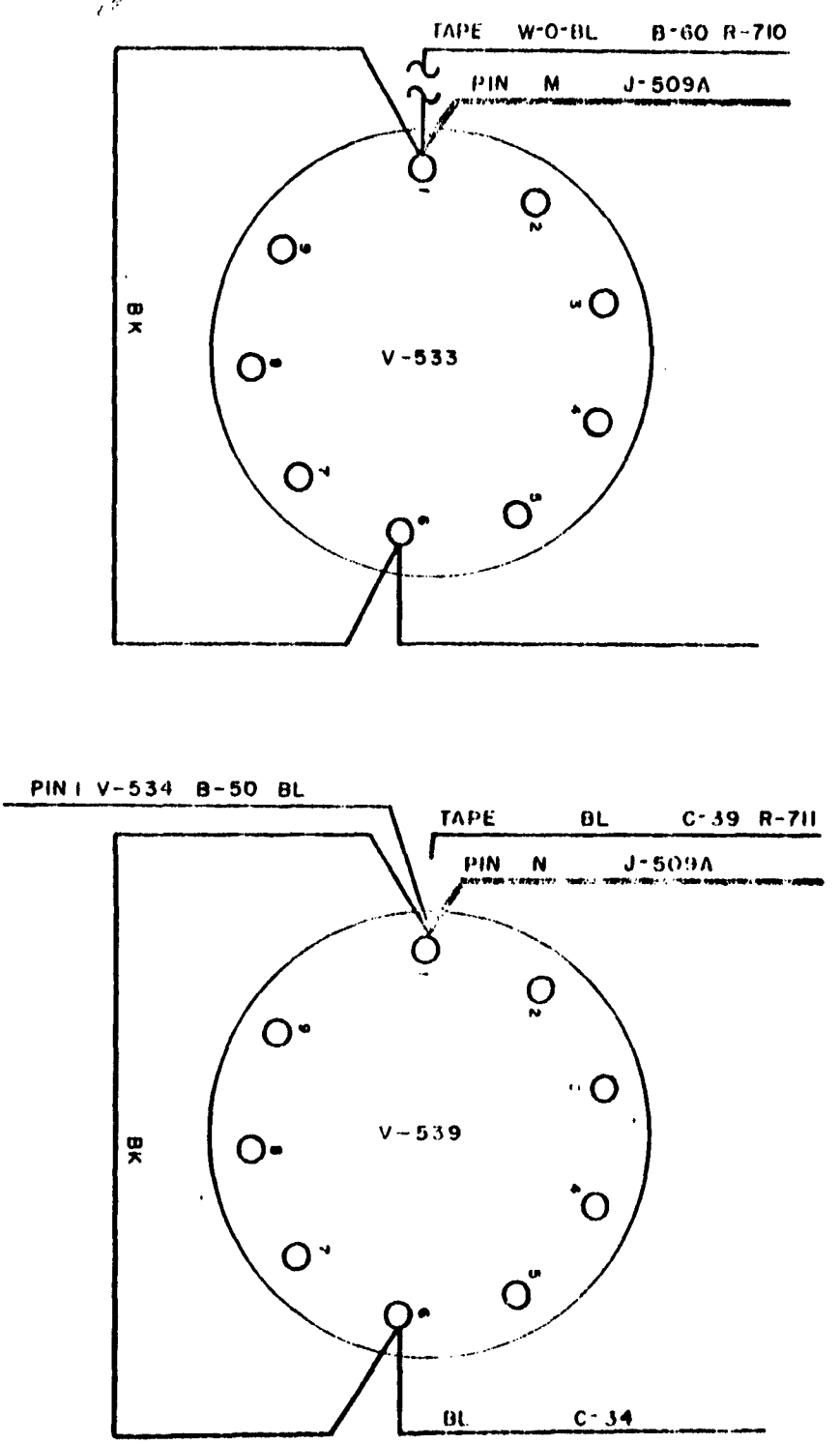


Figure 2-28 Receiving Signal Distributor, Unit No. 2, V-533 and V-539

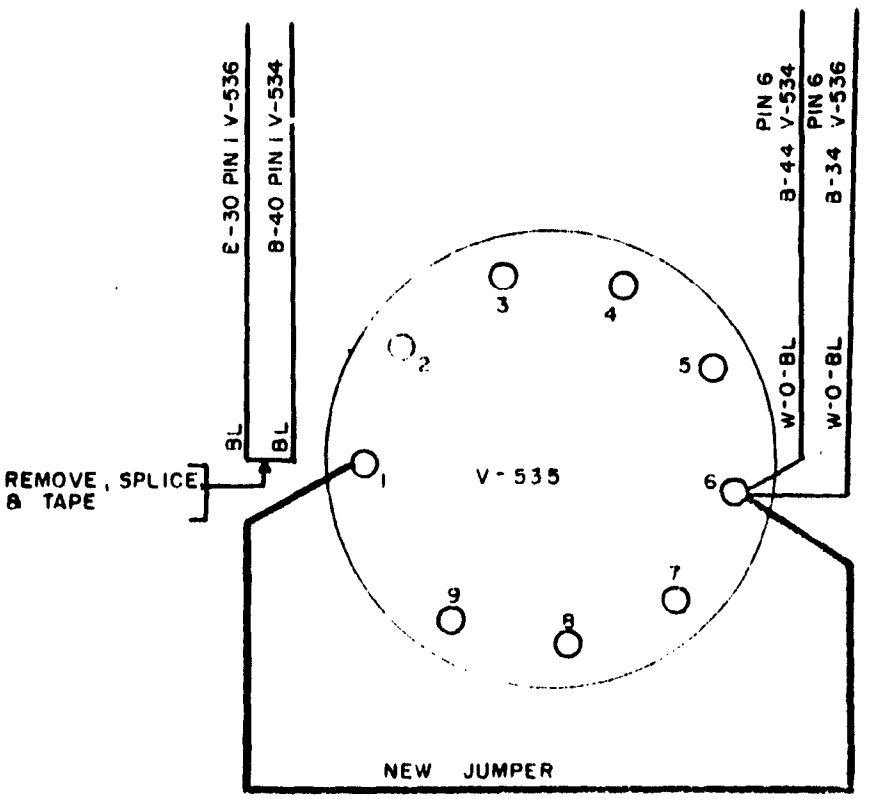


Figure 2-29 Receiving Signal Distributor, Unit No. 2, V-535

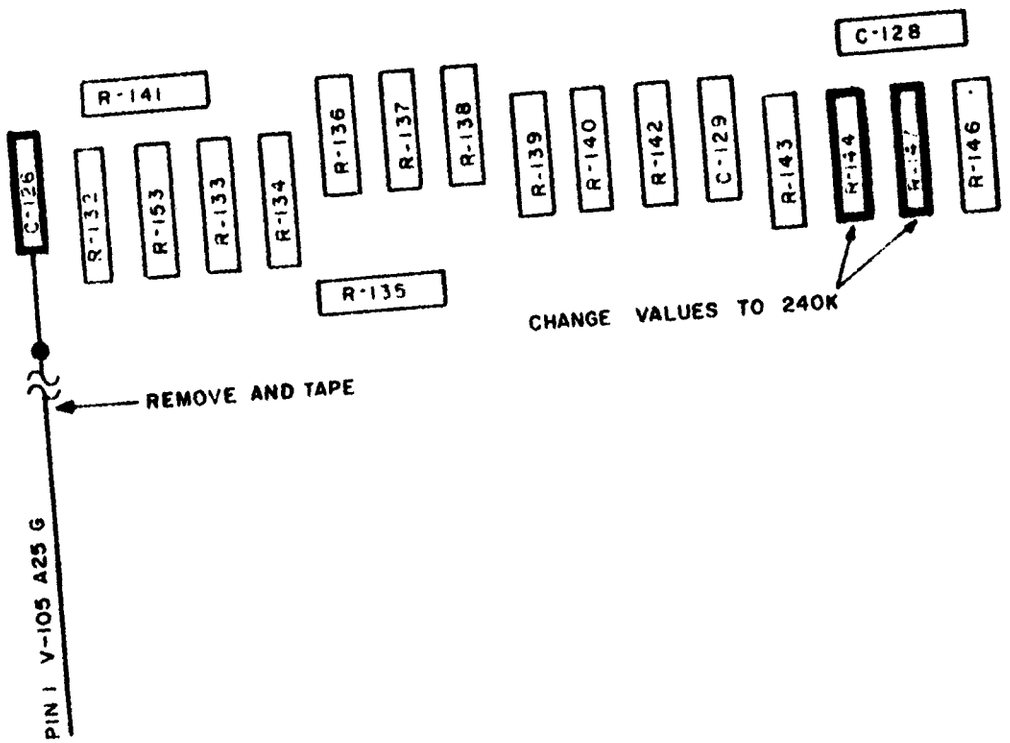


Figure 2-30 Transmitting Signal Distributor Drive, Unit No. 1, TB-103

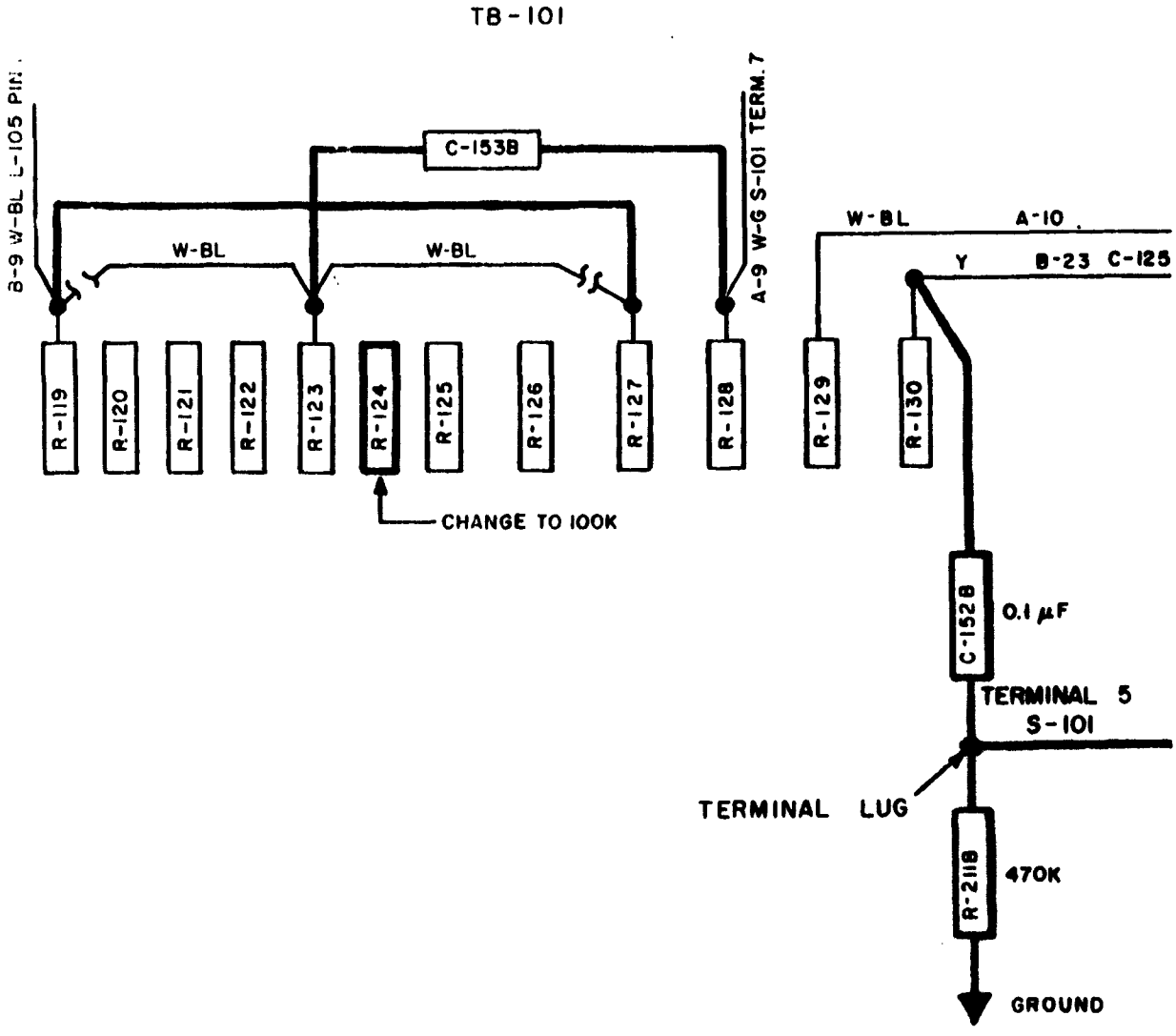


Figure 2-31 Transmitting Signal Distributor Drive, Unit No. 1, TB-101

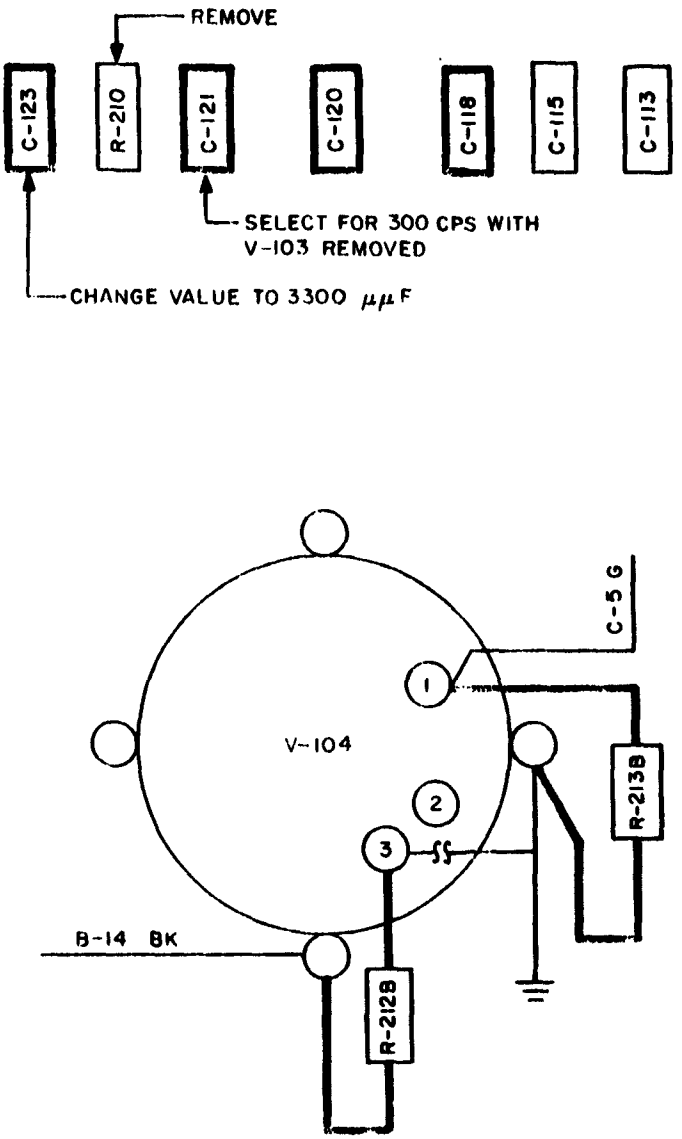
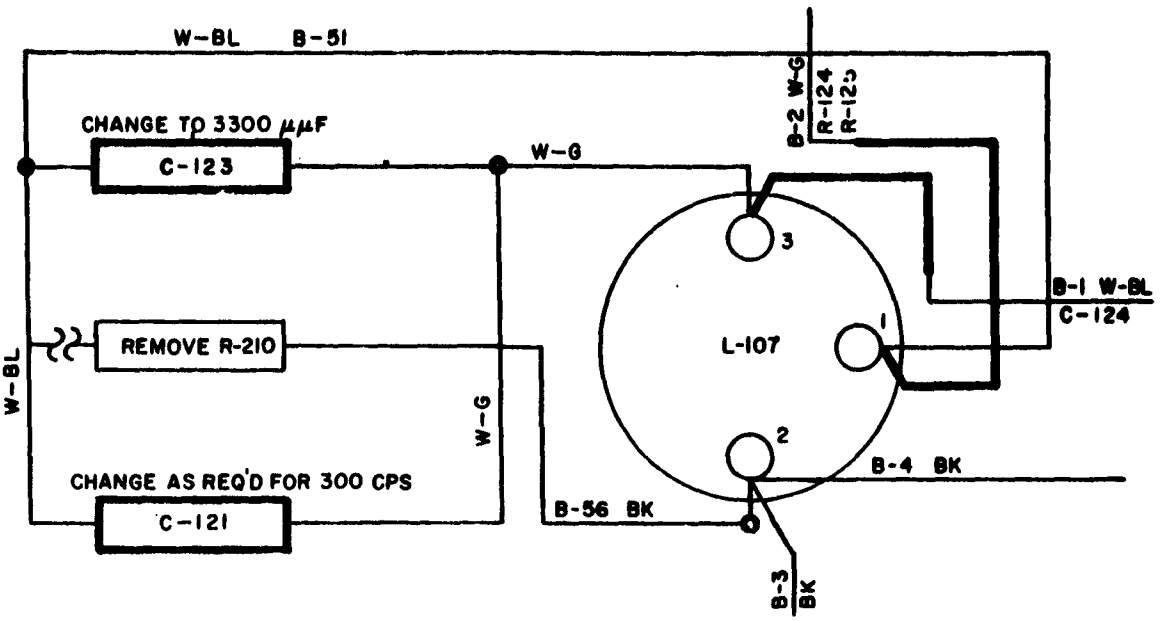
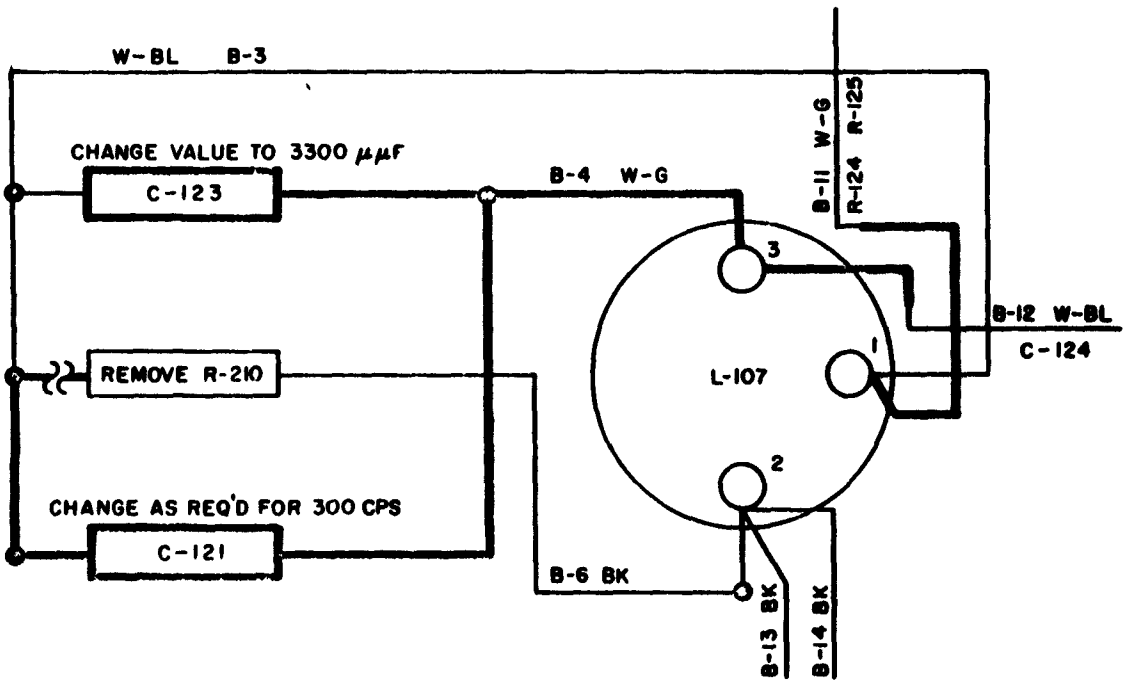


Figure 2-32 Transmitting and Receiving Signal Distributor Drive, Unit No. 1, TB-102



Transmitting Signal Distributor Drive, Unit NO. 1



Receiving Signal Distributor Drive, Unit No. 1

Figure 2-33 Transmitting and Receiving Distributor Drive, Units No. 1, L-107

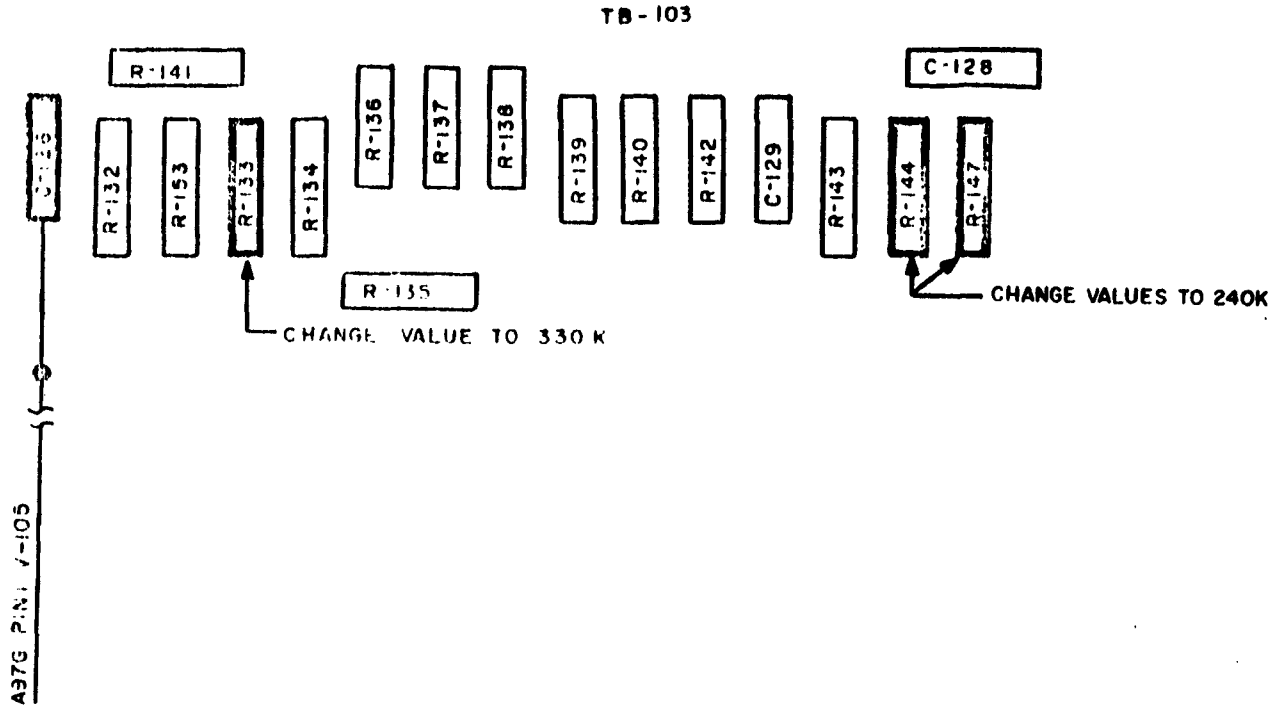


Figure 2-34 Receiving Signal Distributor Drive, Unit No. 1, TB-103

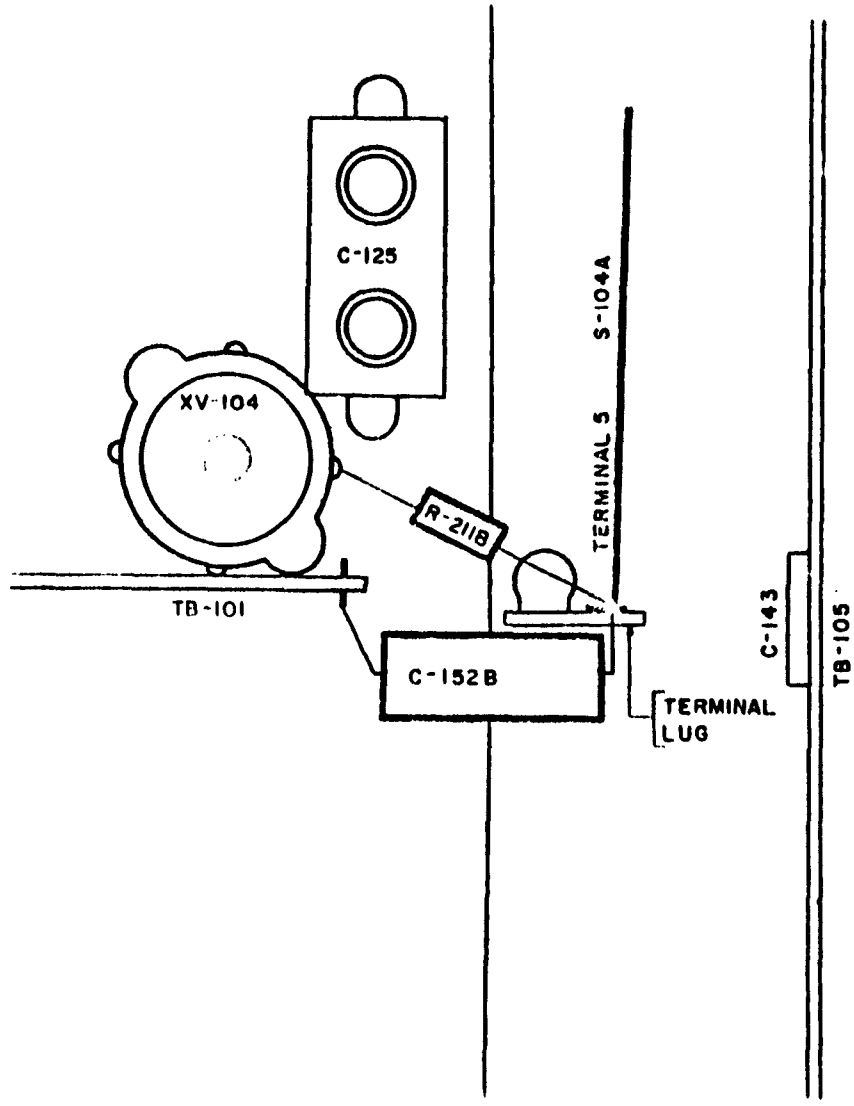


Figure 2-35 Receiving Signal Distributor Drive, Unit No. 1, C-152B

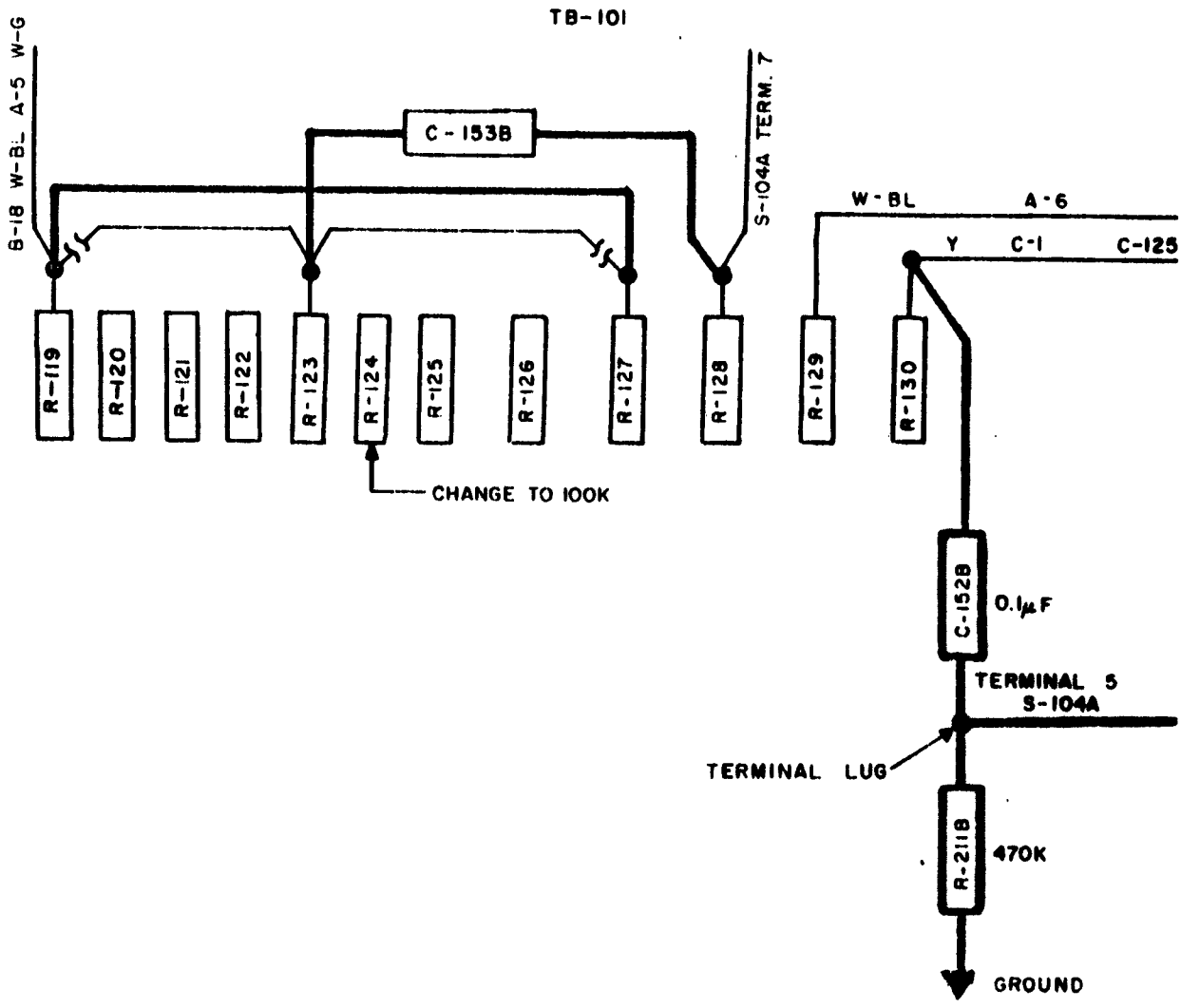


Figure 2-36 Receiving Signal Distributor Drive, Unit No. 1, TB-101

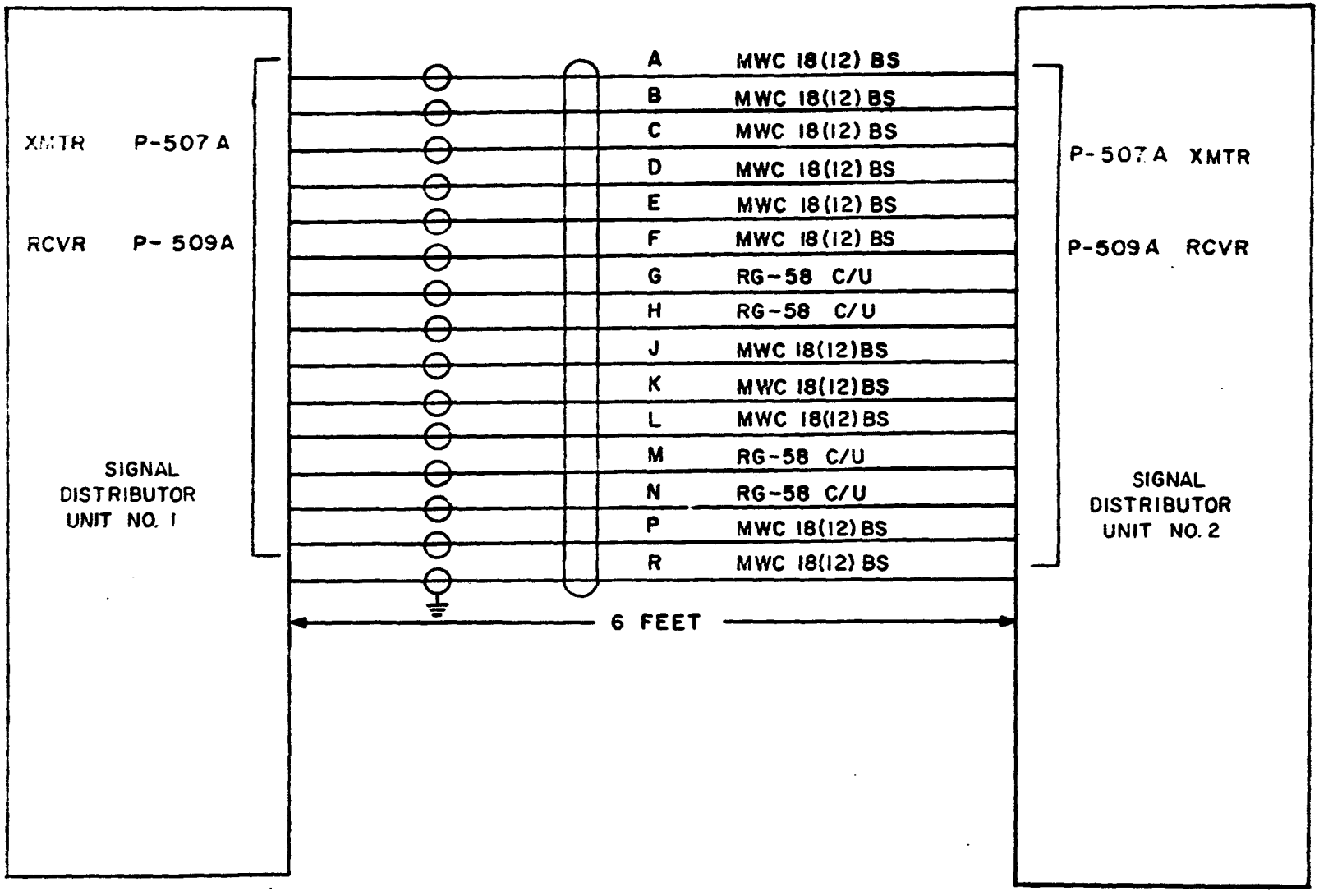
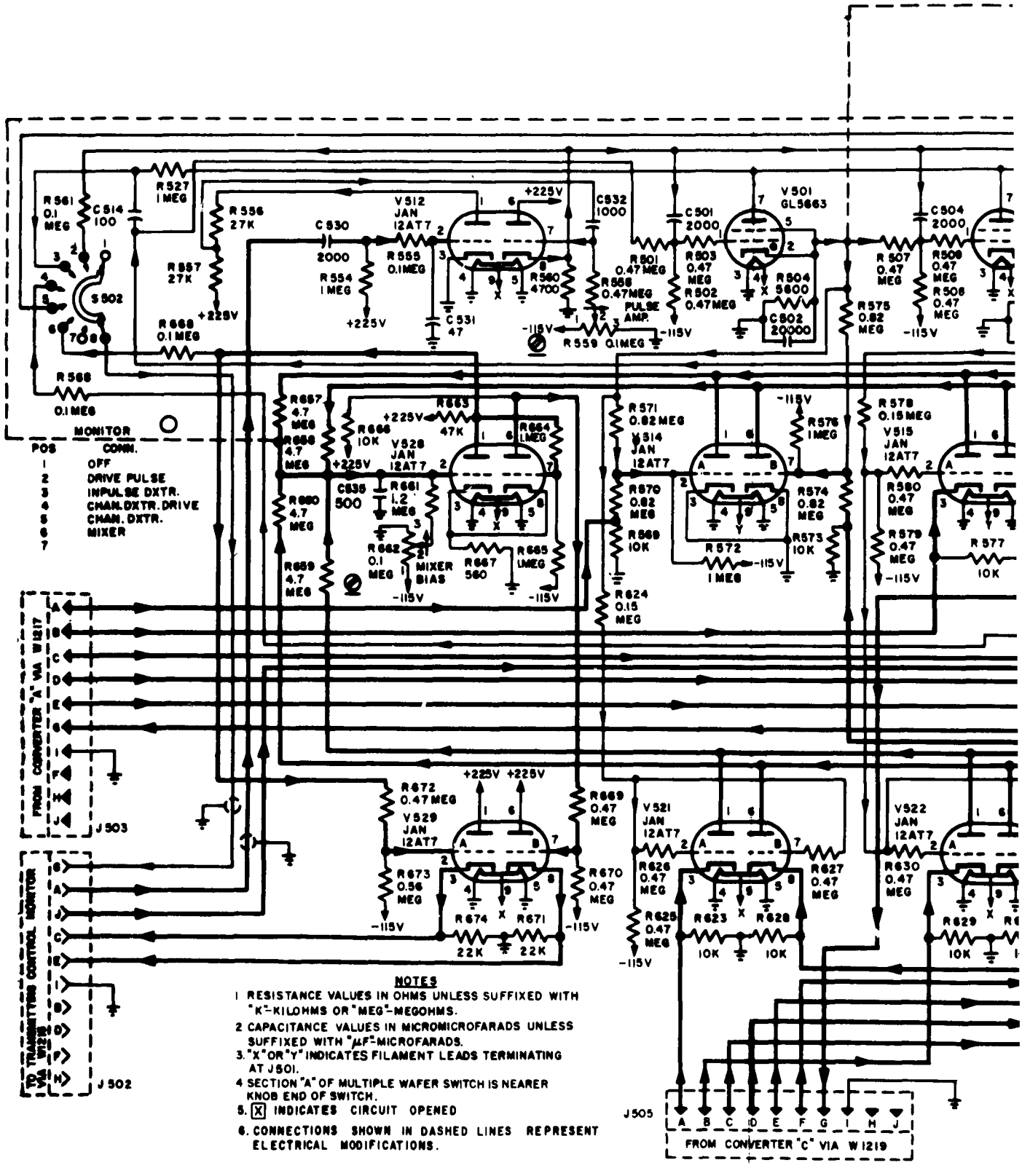
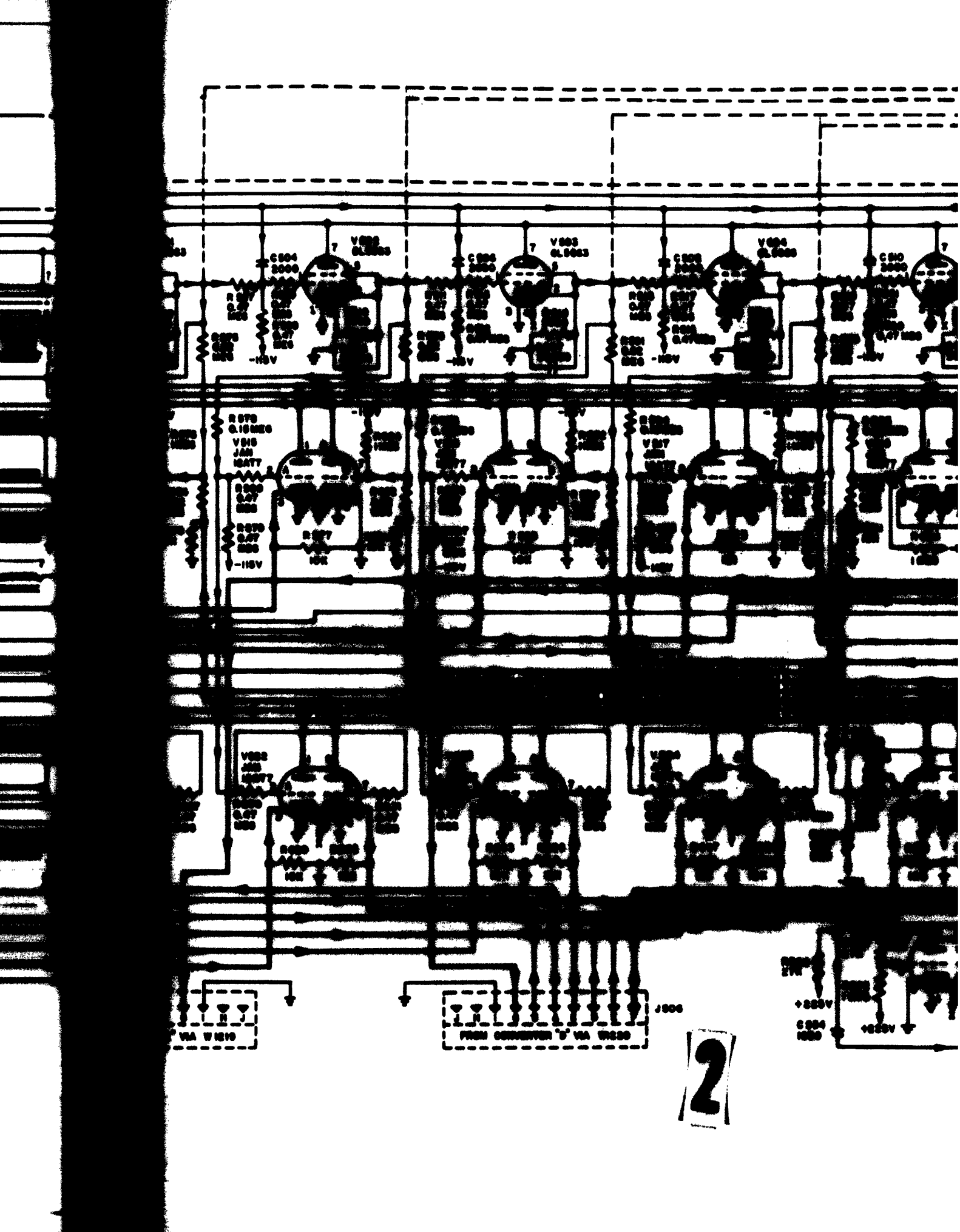


Figure 2-37 Intercabinet Wiring, FGC-5 Terminal


MONITOR
POS CONN.
1 OFF
2 DRIVE PULSE
3 INPULSE DXTR.
4 CHAN.DXTR.DRIVE
5 CHAN. DXTR.
6 MIXER
7
S502
V512 JAN 12AT7
V501 GL5663
V528 JAN 12AT7
V514 JAN 12AT7
V515 JAN 12AT7
V529 JAN 12AT7
V521 JAN 12AT7
V522 JAN 12AT7
+225V
-115V
MIXER BIAS
FROM CONVERTER "A" VIA W1217
J503
TO TRANSMITTING CONTROL MONITOR VIA W1218
J502
J505
FROM CONVERTER "C" VIA W1219
NOTES
1 RESISTANCE VALUES IN OHMS UNLESS SUFFIXED WITH "K"-KILOHMS OR "MEG"-MEGOHMS.
2 CAPACITANCE VALUES IN MICROMICROFARADS UNLESS SUFFIXED WITH "μF"-MICROFARADS.
3. "X" OR "Y" INDICATES FILAMENT LEADS TERMINATING AT J501.
4 SECTION "A" OF MULTIPLE WAFER SWITCH IS NEARER KNOB END OF SWITCH.
5. [X] INDICATES CIRCUIT OPENED
6. CONNECTIONS SHOWN IN DASHED LINES REPRESENT ELECTRICAL MODIFICATIONS.



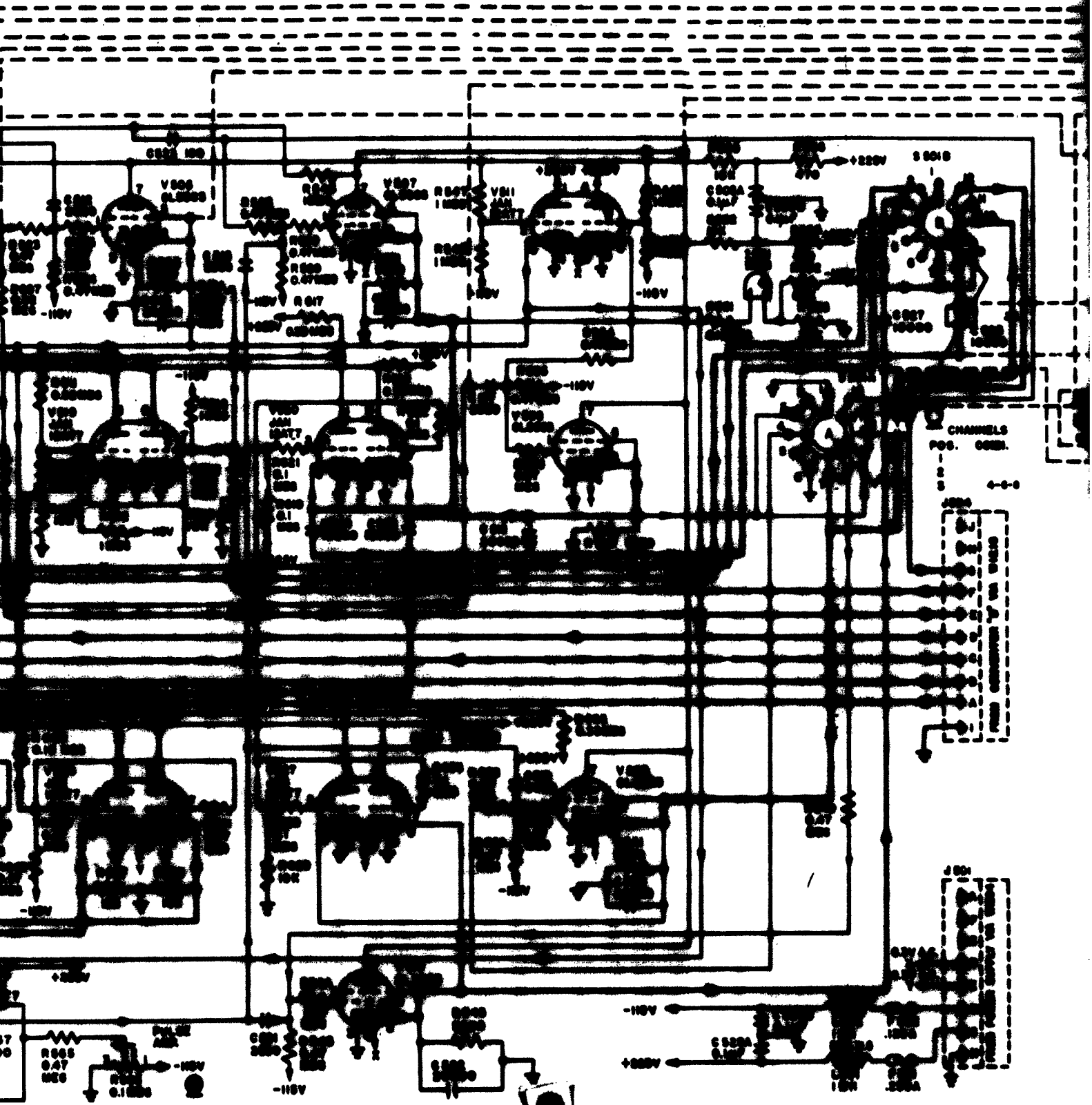
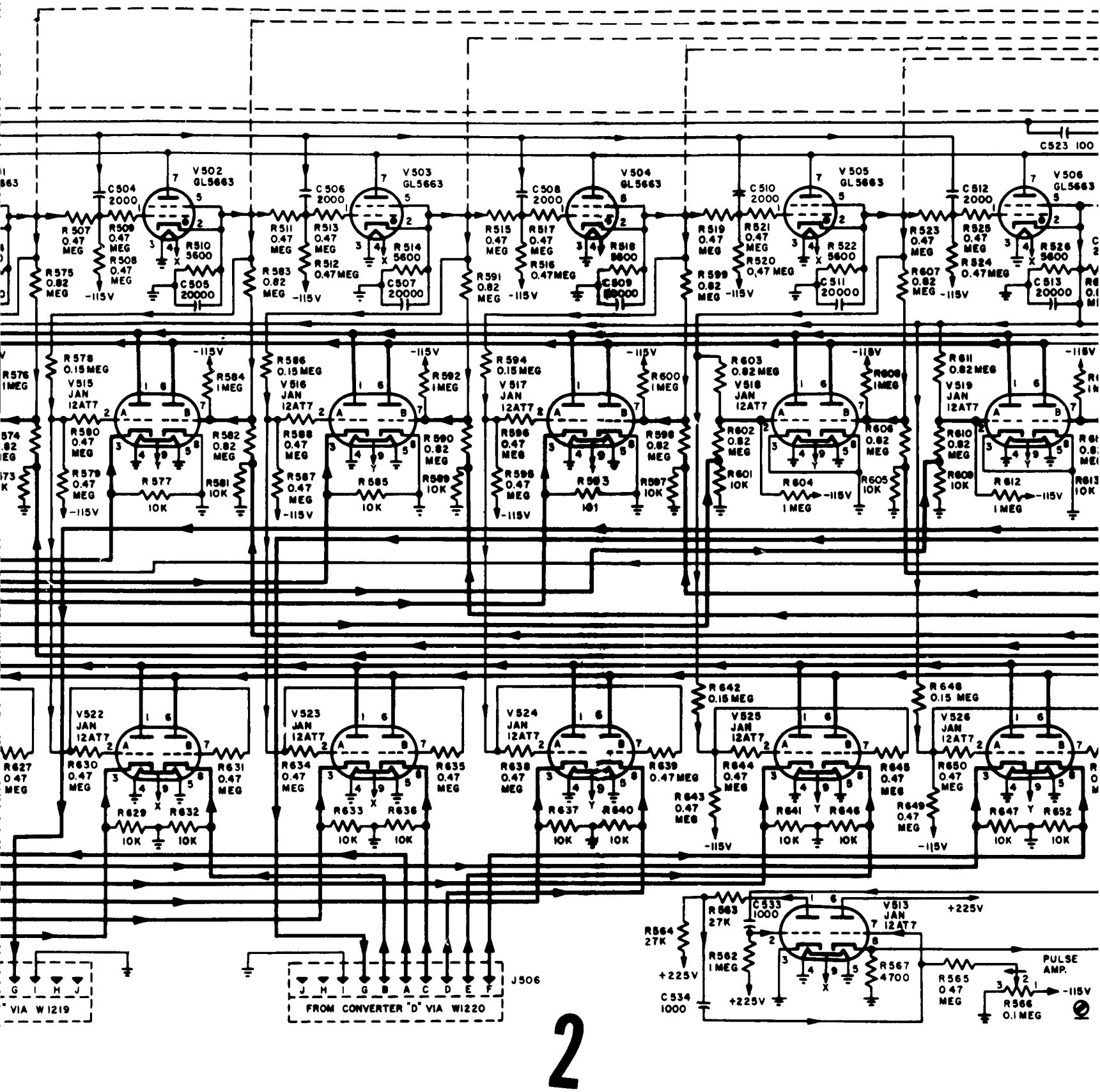


Figure 2-38. Transm
TT-58/FGC-5, U
Schematic Diagram 1


V502 GL5663
V503 GL5663
V504 GL5663
V505 GL5663
V506 GL5663
C504 2000
C506 2000
C508 2000
C510 2000
C512 2000
C523 100
R507 0.47 MEG
R509 0.47 MEG
R508 0.47 MEG
R510 5600
C505 20000
R511 0.47 MEG
R513 0.47 MEG
R512 0.47MEG
R514 5600
C507 20000
R515 0.47 MEG
R517 0.47 MEG
R516 0.47MEG
R518 5600
C509 20000
R519 0.47 MEG
R521 0.47 MEG
R520 0.47 MEG
R522 5600
C511 20000
R523 0.47 MEG
R525 0.47 MEG
R524 0.47MEG
R526 5600
C513 20000
R575 0.82 MEG
R583 0.82 MEG
R591 0.82 MEG
R599 0.82 MEG
R607 0.82 MEG
-115V
R578 0.15MEG
R586 0.15MEG
R594 0.15MEG
R603 0.82 MEG
R611 0.82 MEG
V515 JAN 12AT7
V516 JAN 12AT7
V517 JAN 12AT7
V518 JAN 12AT7
V519 JAN 12AT7
R584 1MEG
R592 1MEG
R600 1MEG
R608 1MEG
R580 0.47 MEG
R588 0.47 MEG
R596 0.47 MEG
R602 0.82 MEG
R610 0.82 MEG
R582 0.82 MEG
R590 0.82 MEG
R598 0.82 MEG
R606 0.82 MEG
R579 0.47 MEG
R587 0.47 MEG
R595 0.47 MEG
R601 10K
R609 10K
R577 10K
R585 10K
R593 101
R597 10K
R604 1 MEG
R605 10K
R612 1 MEG
R581 10K
R589 10K
R613 10K
R642 0.15 MEG
R648 0.15 MEG
V522 JAN 12AT7
V523 JAN 12AT7
V524 JAN 12AT7
V525 JAN 12AT7
V526 JAN 12AT7
R630 0.47 MEG
R634 0.47 MEG
R638 0.47 MEG
R644 0.47 MEG
R650 0.47 MEG
R631 0.47 MEG
R635 0.47 MEG
R639 0.47MEG
R645 0.47 MEG
R629 R632
R633 R636
R637 R640
R641 R646
R647 R652
10K 10K
R643 0.47 MEG
R649 0.47 MEG
R563 27K
C533 1000
V513 JAN 12AT7
+225V
R564 27K
R562 1 MEG
R567 4700
C534 1000
R565 0.47 MEG
R566 0.1 MEG
PULSE AMP.
G I H J
VIA W1219
J H I G B A C D E F
J506
FROM CONVERTER "D" VIA W1220

2

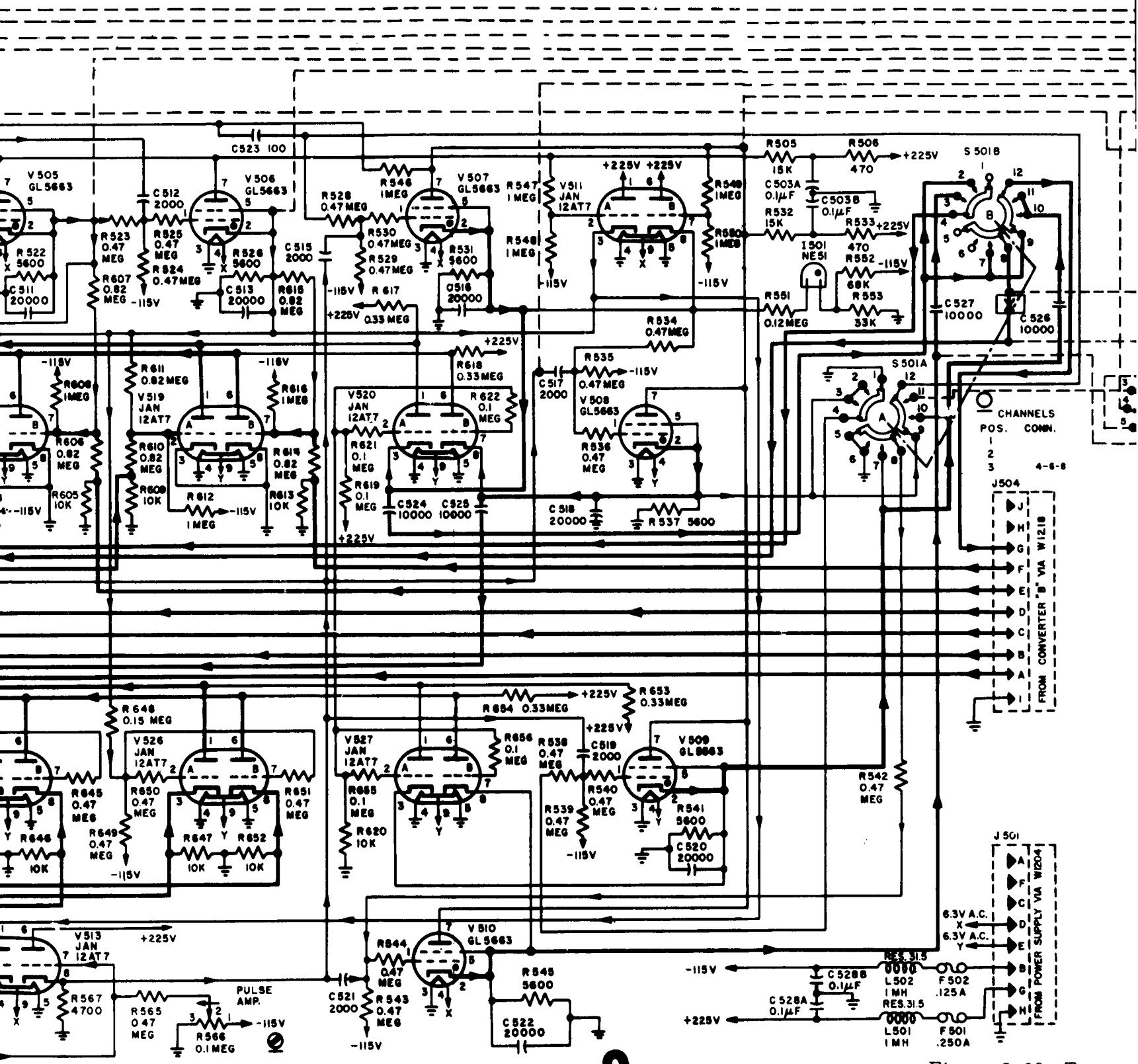


Figure 2-38. Transm
TT-58/FGC-5, U
Schematic Diagram F

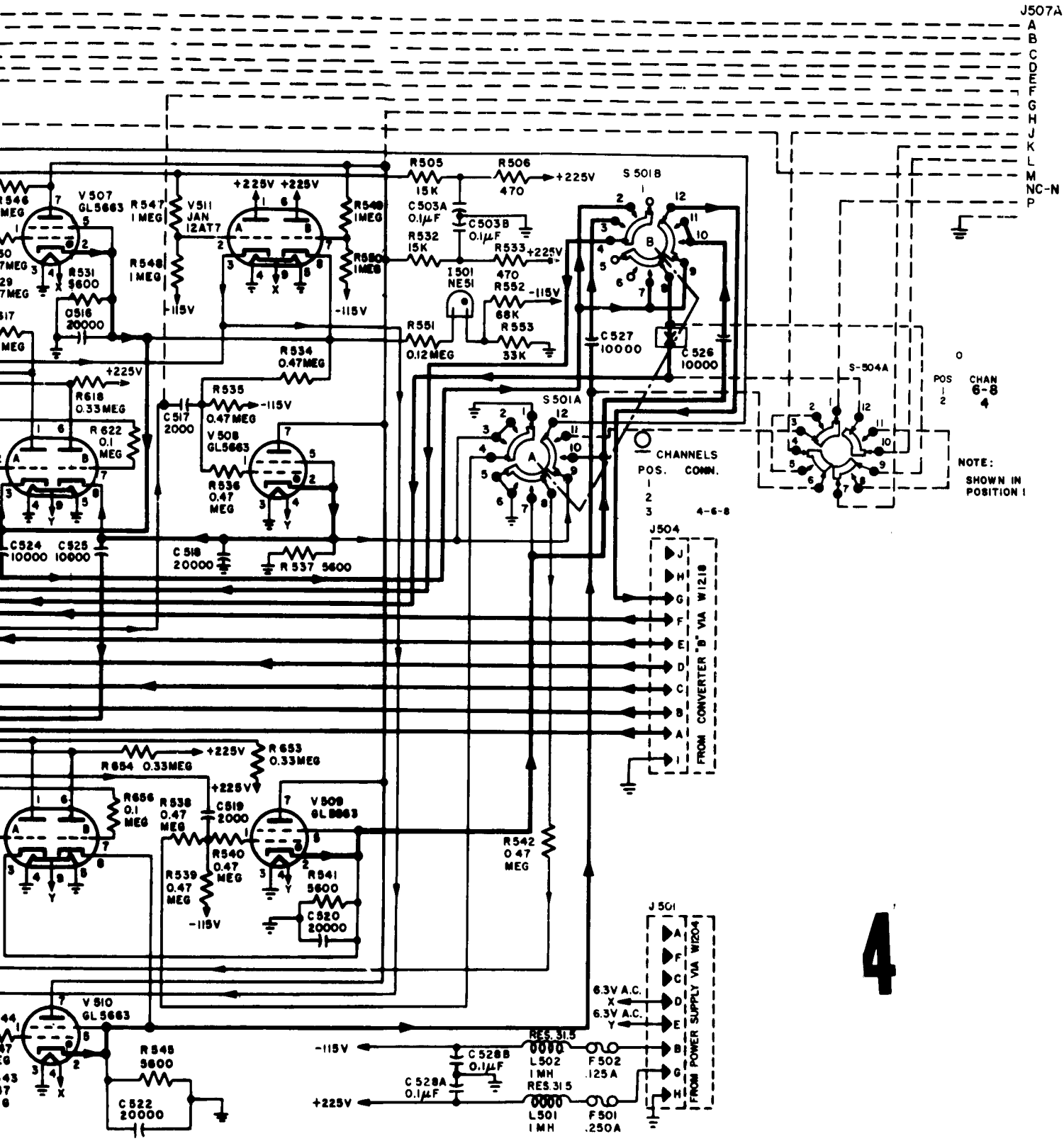
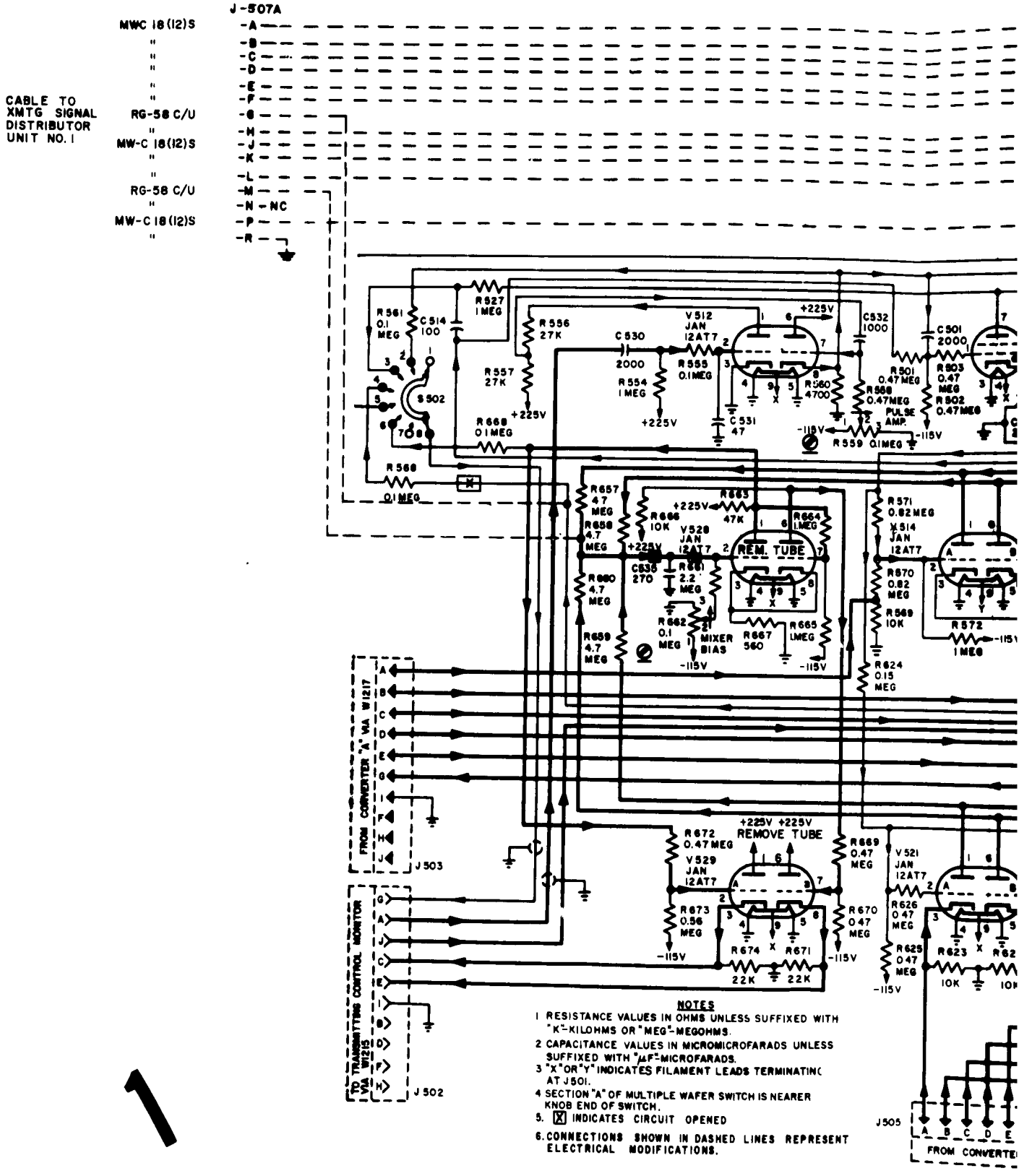
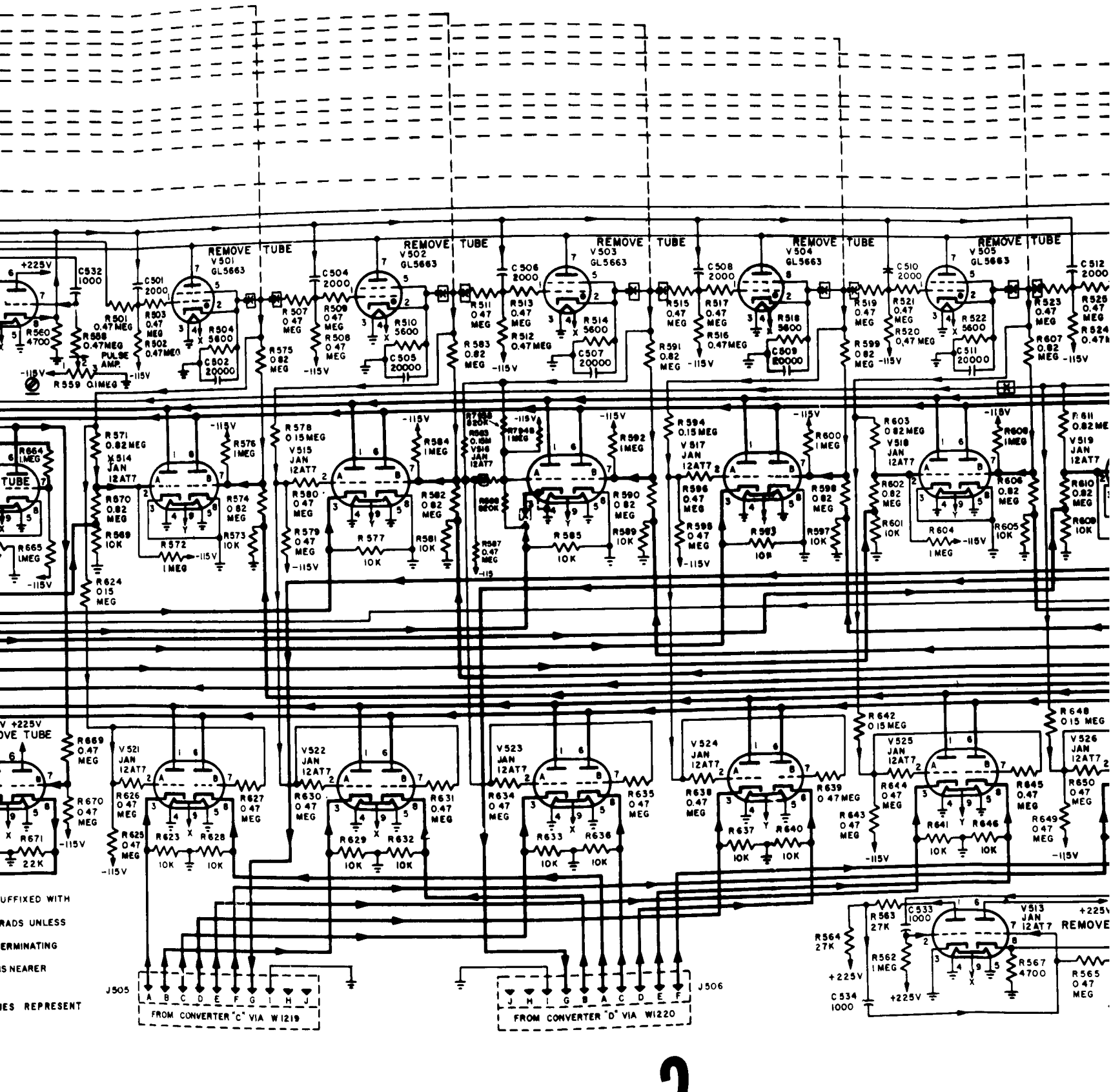


Figure 2-38. Transmitting Signal Distributor TT-58/FGC-5, Unit No. 1, Modified Schematic Diagram For 8-Channel Operation


J-507A
MWC 18(12)S
MW-C 18(12)S
RG-58 C/U
CABLE TO XMTG SIGNAL DISTRIBUTOR UNIT NO. 1
-A
-B
-C
-D
-E
-F
-G
-H
-J
-K
-L
-M
-N - NC
-P
-R
S502
V512 JAN 12AT7
V528 JAN 12AT7
REM. TUBE
V529 JAN 12AT7
REMOVE TUBE
V514 JAN 12AT7
V521 JAN 12AT7
+225V
-115V
MIXER BIAS
PULSE AMP.
FROM CONVERTER "A" VIA W1217
TO TRANSMITTING CONTROL MONITOR VIA W1215
J503
J502
J505
NOTES
1 RESISTANCE VALUES IN OHMS UNLESS SUFFIXED WITH "K"-KILOHMS OR "MEG"-MEGOHMS.
2 CAPACITANCE VALUES IN MICROMICROFARADS UNLESS SUFFIXED WITH "μF"-MICROFARADS.
3 "X" OR "Y" INDICATES FILAMENT LEADS TERMINATING AT J501.
4 SECTION "A" OF MULTIPLE WAFER SWITCH IS NEARER KNOB END OF SWITCH.
5. [X] INDICATES CIRCUIT OPENED
6. CONNECTIONS SHOWN IN DASHED LINES REPRESENT ELECTRICAL MODIFICATIONS.


REMOVE V501 GL5663 TUBE
REMOVE V502 GL5663 TUBE
REMOVE V503 GL5663 TUBE
REMOVE V504 GL5663 TUBE
REMOVE V505 GL5663 TUBE
+225V
C532 1000
R501 0.47 MEG
R558 0.47MEG PULSE AMP.
R559 0.1MEG
C501 2000
R503 0.47 MEG
R502 0.47MEG
R504 5600
C502 20000
R507 0.47 MEG
C504 2000
R509 0.47 MEG
R508 0.47 MEG
R510 5600
C505 20000
R575 0.82 MEG
R511 0.47 MEG
C506 2000
R513 0.47 MEG
R512 0.47MEG
R514 5600
C507 20000
R583 0.82 MEG
R515 0.47 MEG
C508 2000
R517 0.47 MEG
R516 0.47MEG
R518 5600
C509 20000
R591 0.82 MEG
R519 0.47 MEG
C510 2000
R521 0.47 MEG
R520 0.47 MEG
R522 5600
C511 20000
R599 0.82 MEG
R523 0.47 MEG
C512 2000
R525 0.47 MEG
R524 0.47M
R607 0.82 MEG
-115V
R571 0.82 MEG
X514 JAN 12AT7
R570 0.82 MEG
R569 10K
R572 1 MEG
R574 0.82 MEG
R573 10K
R576 1MEG
R624 0.15 MEG
R578 0.15MEG
V515 JAN 12AT7
R580 0.47 MEG
R579 0.47 MEG
R577 10K
R582 0.82 MEG
R581 10K
R584 1MEG
R587 0.47 MEG
R585 10K
R590 0.82 MEG
R589 10K
R592 1MEG
R594 0.15 MEG
V517 JAN 12AT7
R596 0.47 MEG
R595 0.47 MEG
R593 10K
R598 0.82 MEG
R597 10K
R600 1MEG
R603 0.82 MEG
V518 JAN 12AT7
R602 0.82 MEG
R601 10K
R604 1 MEG
R606 0.82 MEG
R605 10K
R608 1MEG
R611 0.82 ME
V519 JAN 12AT7
R610 0.82 MEG
R609 10K
R664 1MEG
R665 1MEG
R669 0.47 MEG
R670 0.47 MEG
R671 22K
V521 JAN 12AT7
R626 0.47 MEG
R625 0.47 MEG
R623 10K
R628 10K
R627 0.47 MEG
V522 JAN 12AT7
R630 0.47 MEG
R629 10K
R632 10K
R631 0.47 MEG
V523 JAN 12AT7
R634 0.47 MEG
R633 10K
R636 10K
R635 0.47 MEG
V524 JAN 12AT7
R638 0.47 MEG
R637 10K
R640 10K
R639 0.47MEG
R643 0.47 MEG
R642 0.15 MEG
V525 JAN 12AT7
R644 0.47 MEG
R641 10K
R646 10K
R645 0.47 MEG
R649 0.47 MEG
R648 0.15 MEG
V526 JAN 12AT7
R650 0.47 MEG
UFFIXED WITH
RADS UNLESS
ERMINATING
S NEARER
ES REPRESENT
J505
A B C D E F G I H J
FROM CONVERTER "C" VIA W1219
J506
J H I G B A C D E F
FROM CONVERTER "D" VIA W1220
V513 JAN 12AT7
C533 1000
R563 27K
R564 27K
R562 1 MEG
R567 4700
C534 1000
R565 0.47 MEG
REMOVE

2

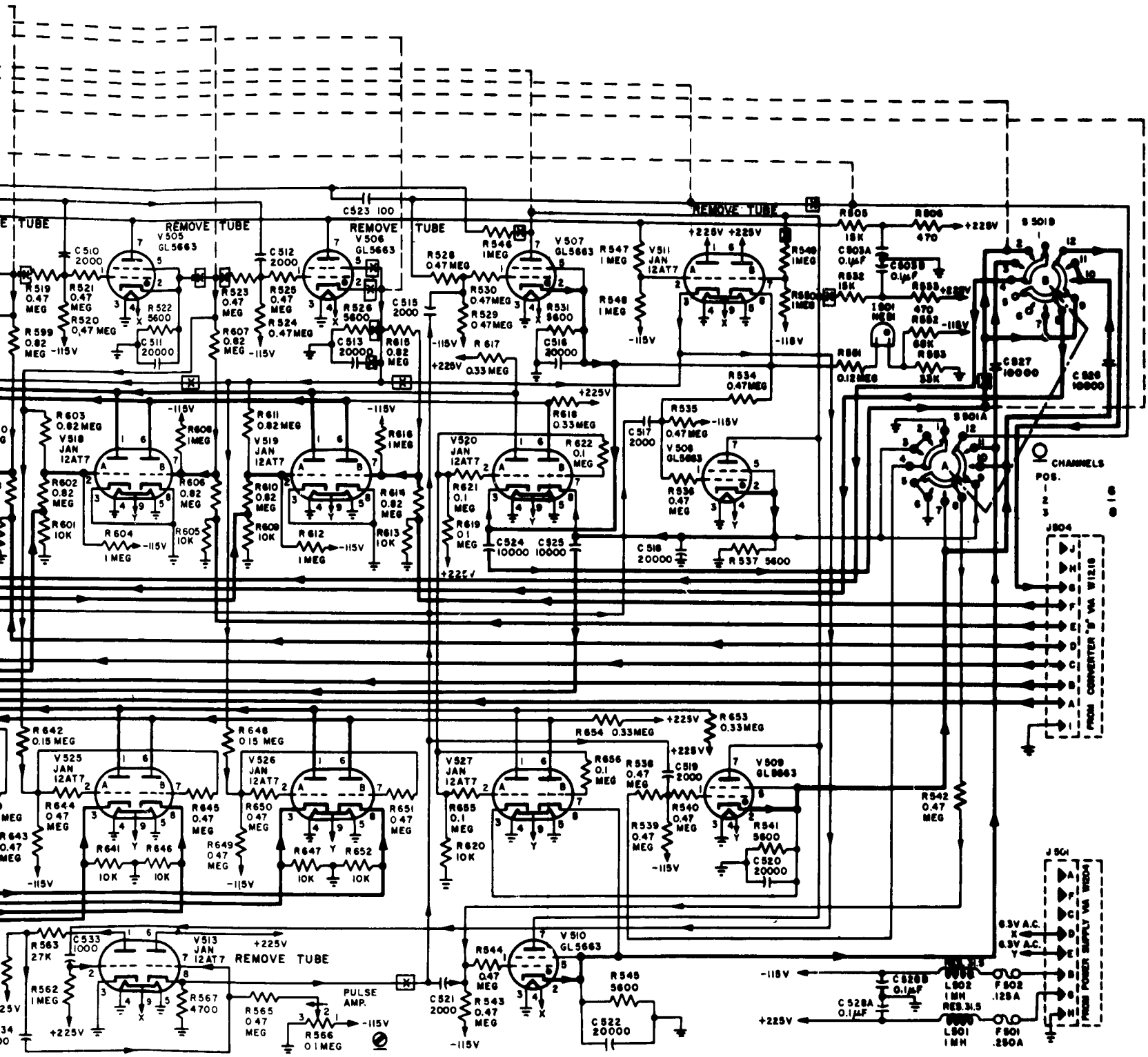


Figure 2-39. Transmitting Signal Distributor TT-58/FGC-5, Unit No. 2, Modified Schematic Diagram For 8-Channel Operation

3

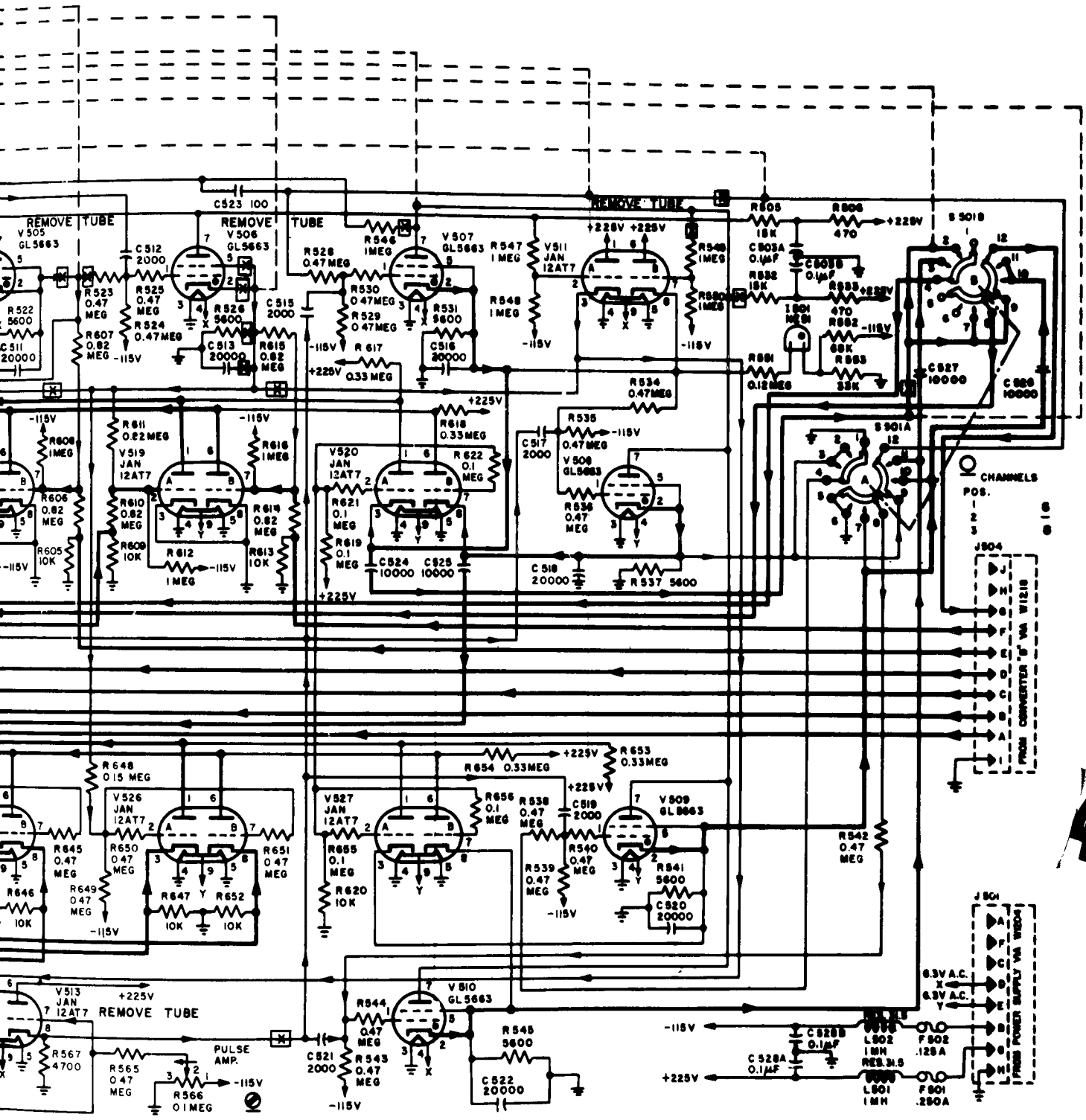
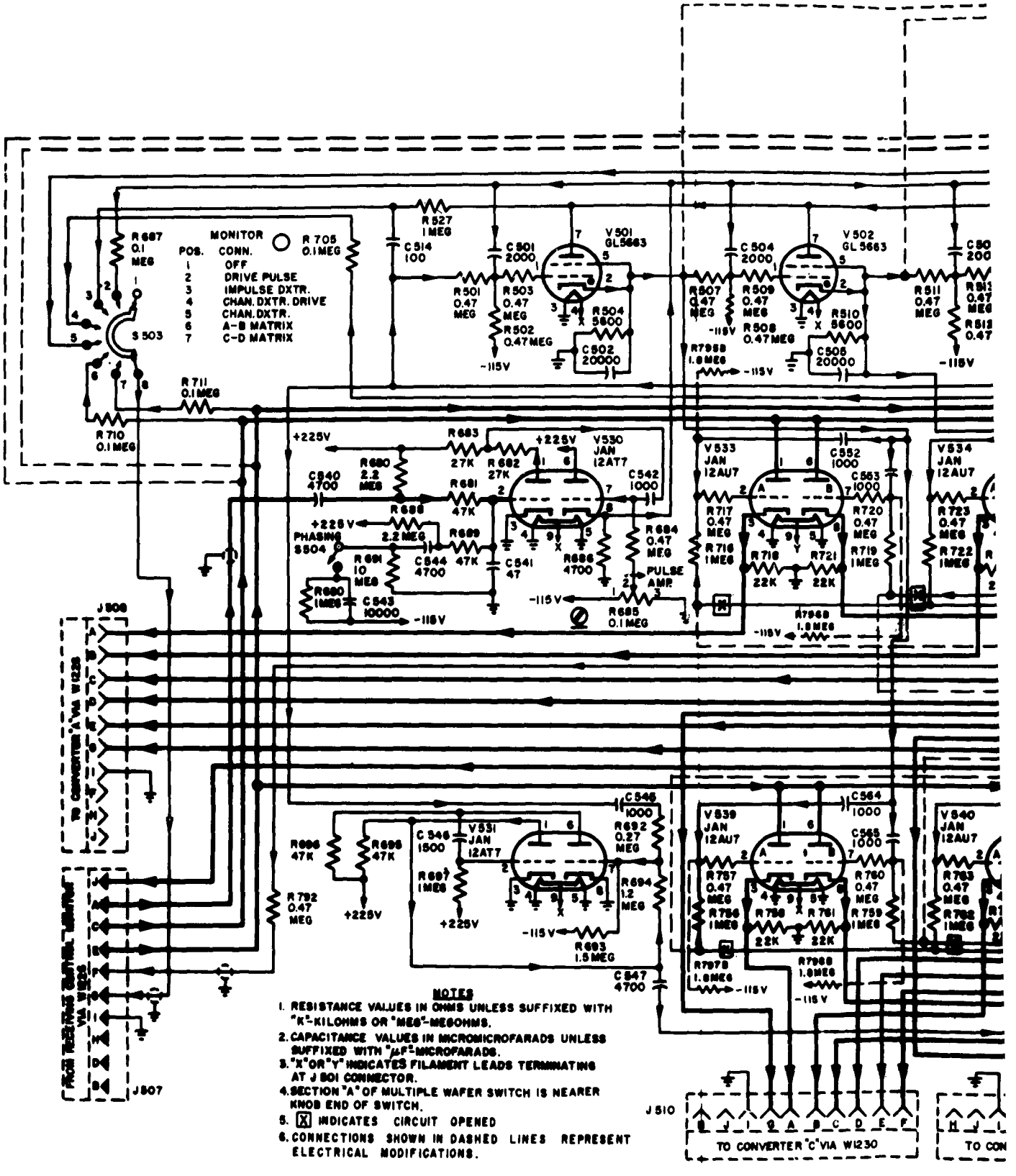
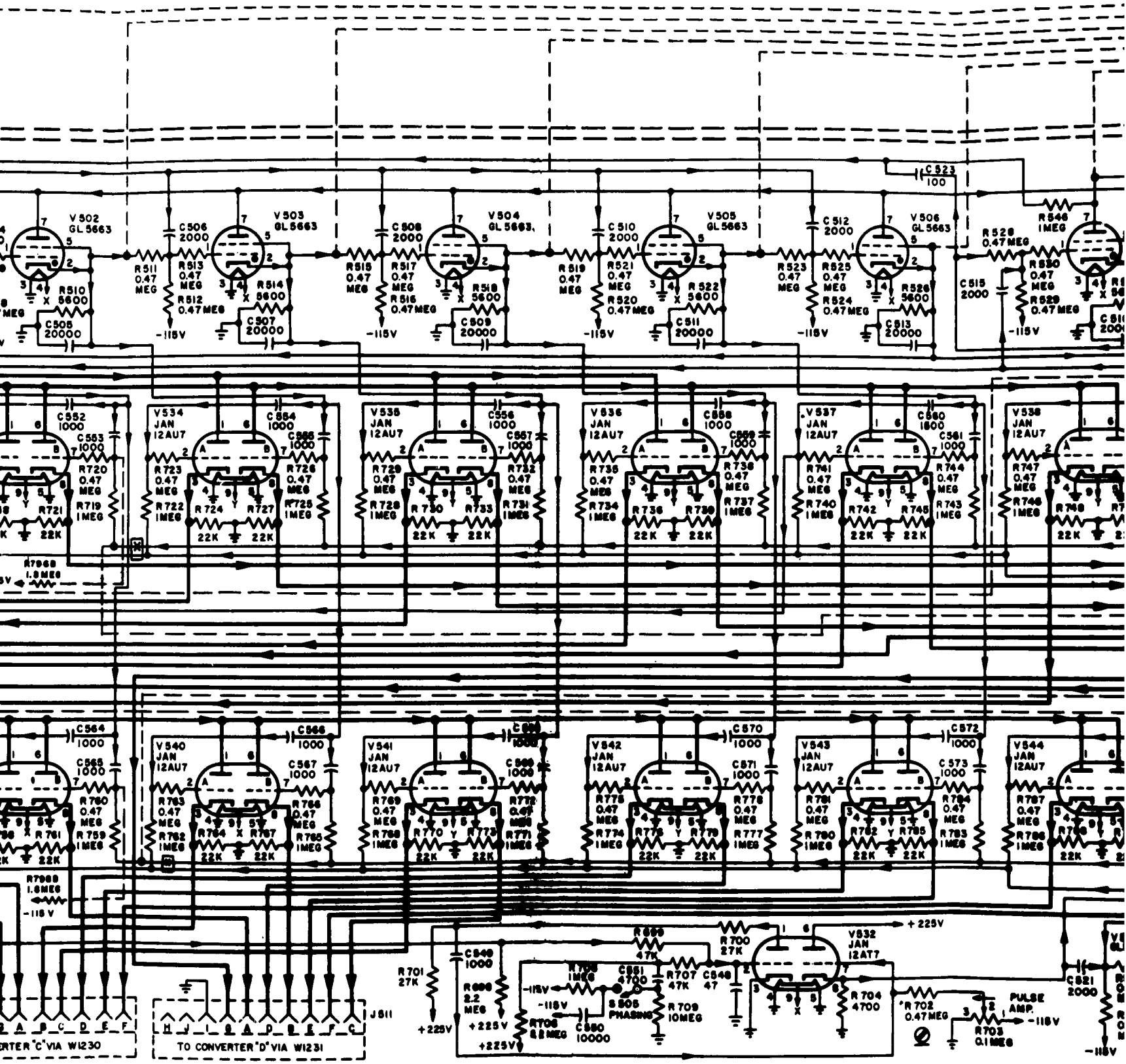


Figure 2-39. Transmitting Signal Distributor TT-58/FGC-5, Unit No. 2, Modified Schematic Diagram For 8-Channel Operation



NOTES

1. RESISTANCE VALUES IN OHMS UNLESS SUFFIXED WITH "K"-KILOHMS OR "MEG"-MEGOHMS.
2. CAPACITANCE VALUES IN MICROMICROFARADS UNLESS SUFFIXED WITH "μF"-MICROFARADS.
3. "X" OR "Y" INDICATES FILAMENT LEADS TERMINATING AT J 501 CONNECTOR.
4. SECTION "A" OF MULTIPLE WAFER SWITCH IS NEARER KNOB END OF SWITCH.
5. [X] INDICATES CIRCUIT OPENED
6. CONNECTIONS SHOWN IN DASHED LINES REPRESENT ELECTRICAL MODIFICATIONS.


V502 GL5663
V503 GL5663
V504 GL5663
V505 GL5663
V506 GL5663
C505 20000
C506 2000
C507 20000
C508 2000
C509 20000
C510 2000
C511 20000
C512 2000
C513 20000
C515 2000
C523 100
R510 5600
R511 0.47 MEG
R512 0.47MEG
R513 0.47 MEG
R514 5600
R515 0.47 MEG
R516 0.47MEG
R517 0.47 MEG
R518 5600
R519 0.47 MEG
R520 0.47MEG
R521 0.47 MEG
R522 5600
R523 0.47 MEG
R524 0.47MEG
R525 0.47 MEG
R526 5600
R528 0.47MEG
R529 0.47MEG
R530 0.47 MEG
R546 1MEG
-115V
V534 JAN 12AU7
V535 JAN 12AU7
V536 JAN 12AU7
V537 JAN 12AU7
V538 JAN 12AU7
C552 1000
C553 1000
C554 1000
C555 1000
C556 1000
C557 1000
C558 1000
C559 1000
C560 1800
C561 1000
R719 1MEG
R720 0.47 MEG
R721 22K
R722 1MEG
R723 0.47 MEG
R724 22K
R725 1MEG
R726 0.47 MEG
R727 22K
R728 1MEG
R729 0.47 MEG
R730 22K
R731 1MEG
R732 0.47 MEG
R733 22K
R734 1MEG
R735 0.47 MEG
R736 22K
R737 1MEG
R738 0.47 MEG
R739 22K
R740 1MEG
R741 0.47 MEG
R742 22K
R743 1MEG
R744 0.47 MEG
R745 22K
R746 1MEG
R747 0.47 MEG
R7968 1.8MEG
V540 JAN 12AU7
V541 JAN 12AU7
V542 JAN 12AU7
V543 JAN 12AU7
V544 JAN 12AU7
C564 1000
C565 1000
C566 1000
C567 1000
C568 1000
C569 1000
C570 1000
C571 1000
C572 1000
C573 1000
R759 1MEG
R760 0.47 MEG
R761 22K
R762 1MEG
R763 0.47 MEG
R764 22K
R765 1MEG
R766 0.47 MEG
R767 22K
R768 1MEG
R769 0.47 MEG
R770 22K
R771 1MEG
R772 0.47 MEG
R773 22K
R774 1MEG
R775 0.47 MEG
R776 22K
R777 1MEG
R778 0.47 MEG
R779 22K
R780 1MEG
R781 0.47 MEG
R782 22K
R783 1MEG
R784 0.47 MEG
R785 22K
R786 1MEG
R787 0.47 MEG
R7968 1.8MEG
-115 V
+225V
V532 JAN 12AT7
C549 1000
C550 10000
C551 4700
C546 47
C821 2000
R699 47K
R700 27K
R701 27K
R702 0.47MEG
R703 0.1MEG
R704 4700
R705 1MEG
R706 6.8MEG
R707 47K
R709 10MEG
R699 2.2 MEG
S505 PHASING
PULSE AMP.
J511
TO CONVERTER 'C' VIA W1230
TO CONVERTER 'D' VIA W1231

2

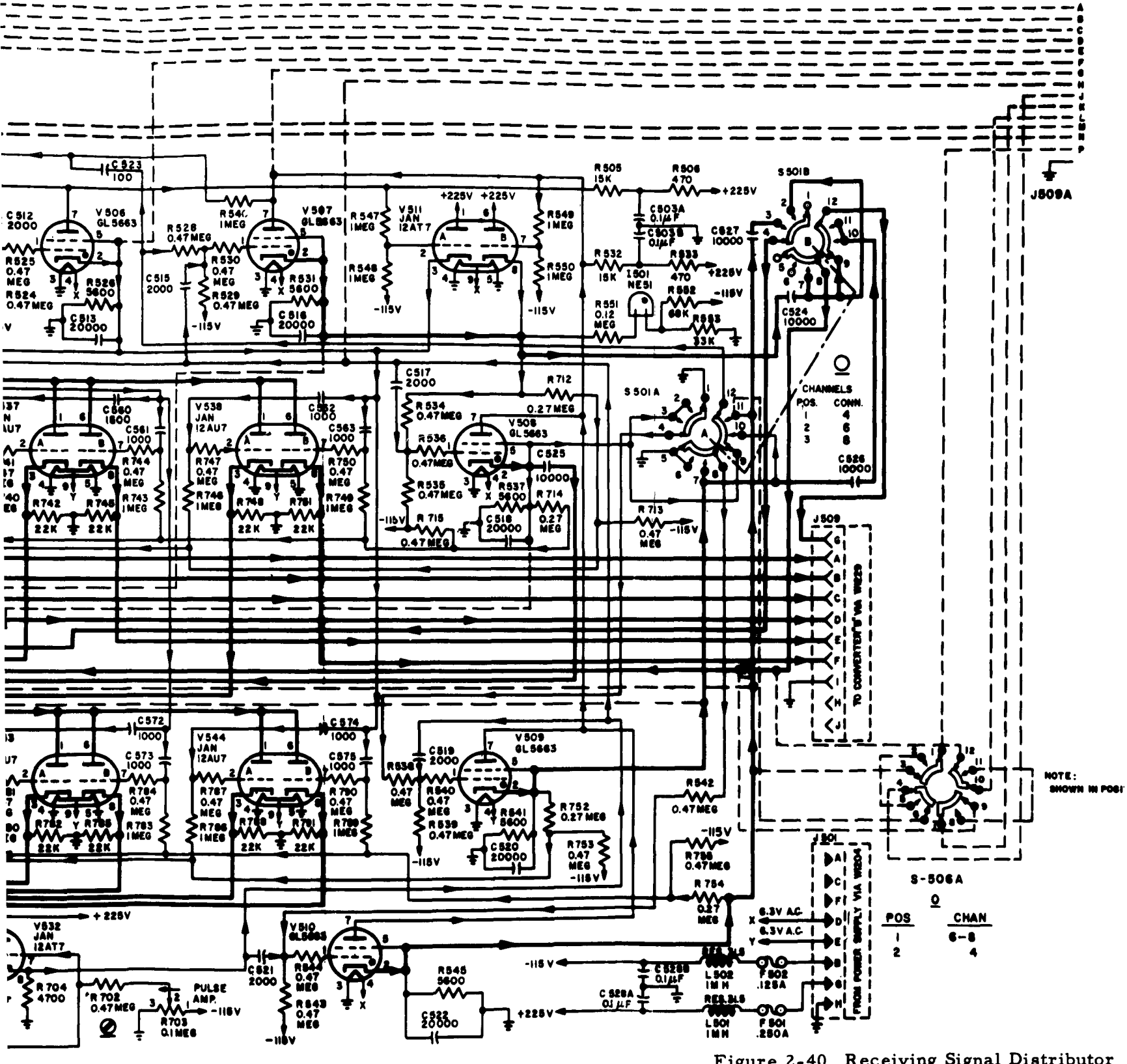


Figure 2-40. Receiving Signal Distributor TT-64/FGC-5, Unit No. 1, Modified Schematic Diagram For 8-Channel Operation

3

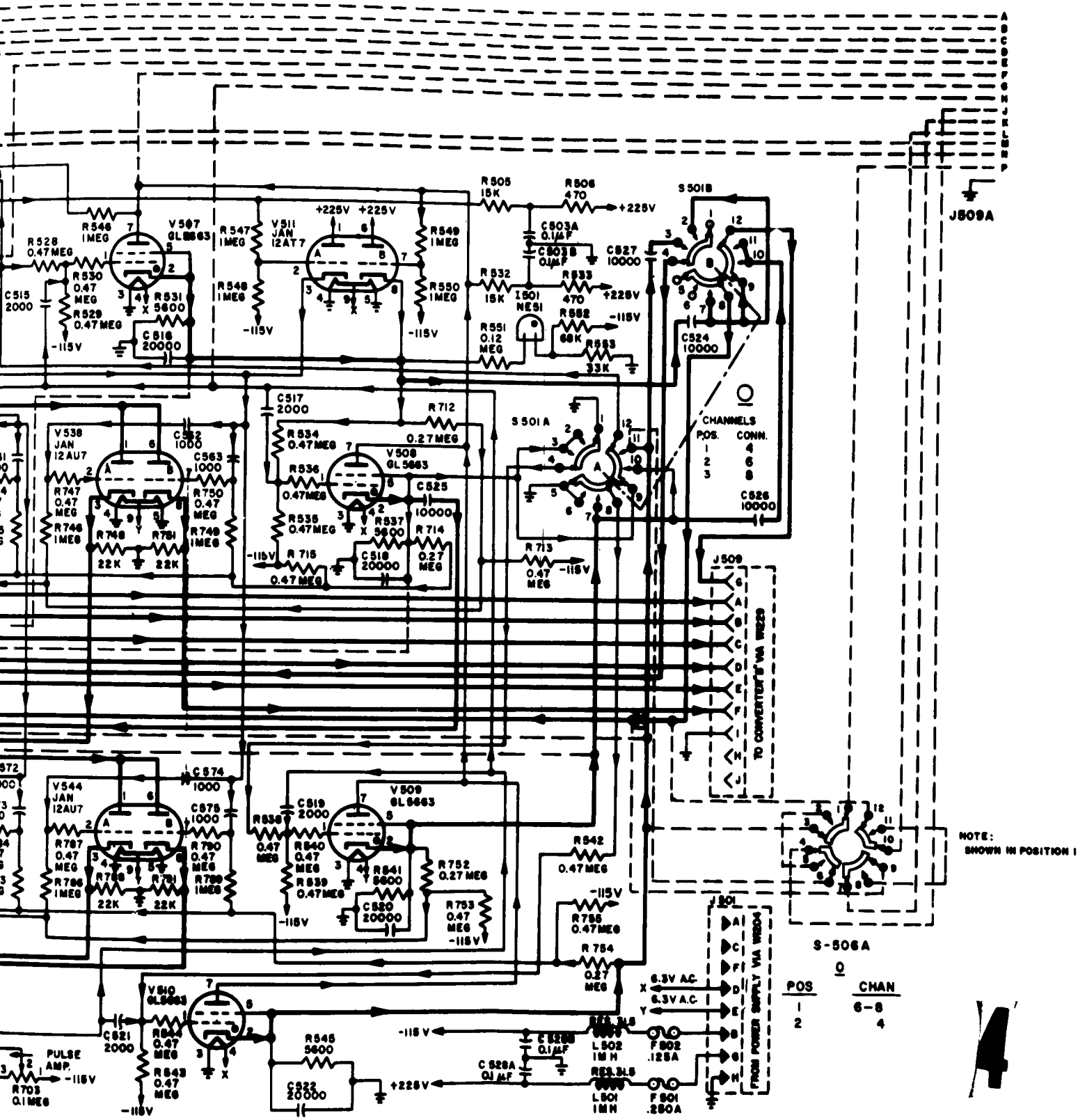
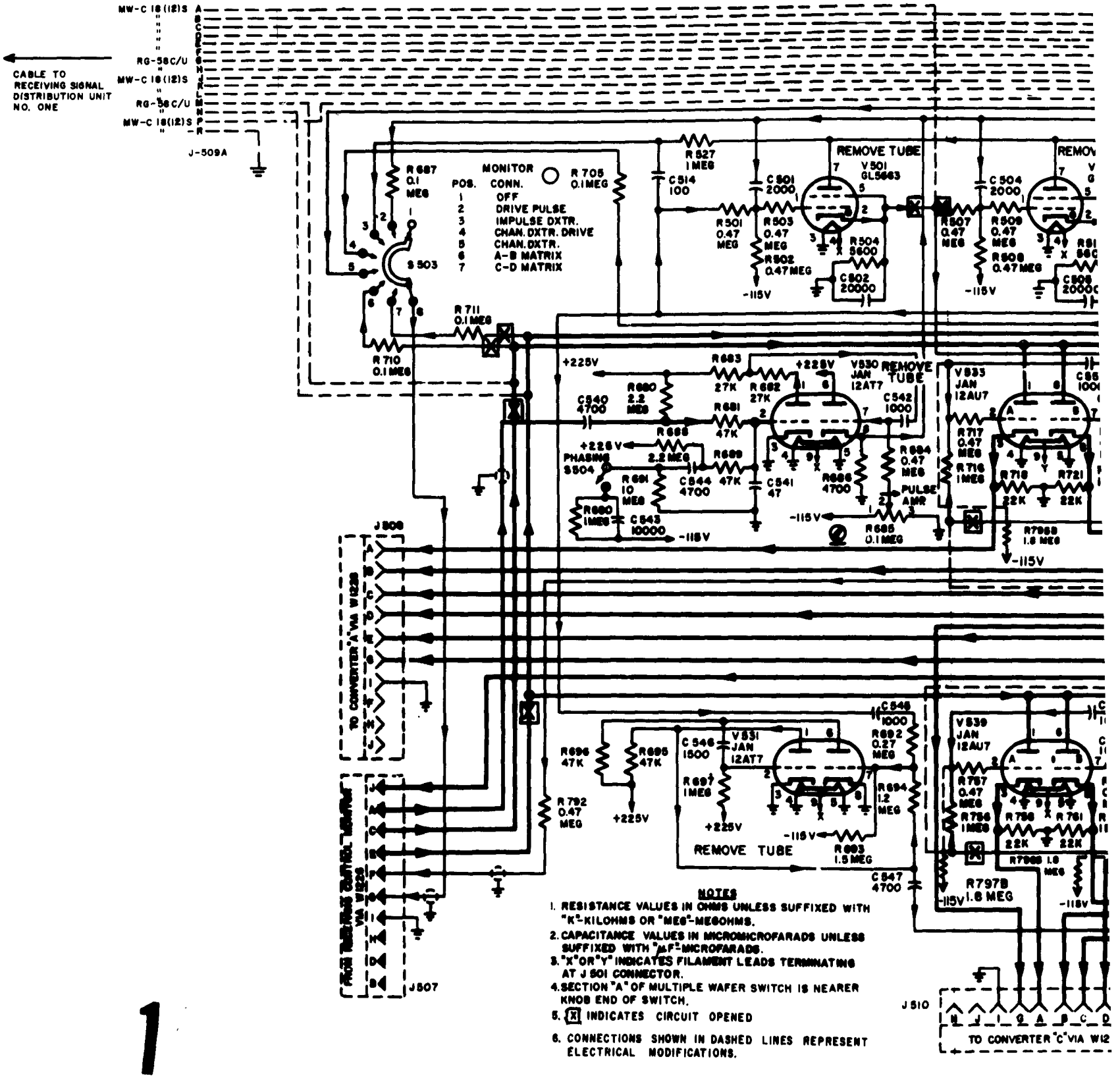


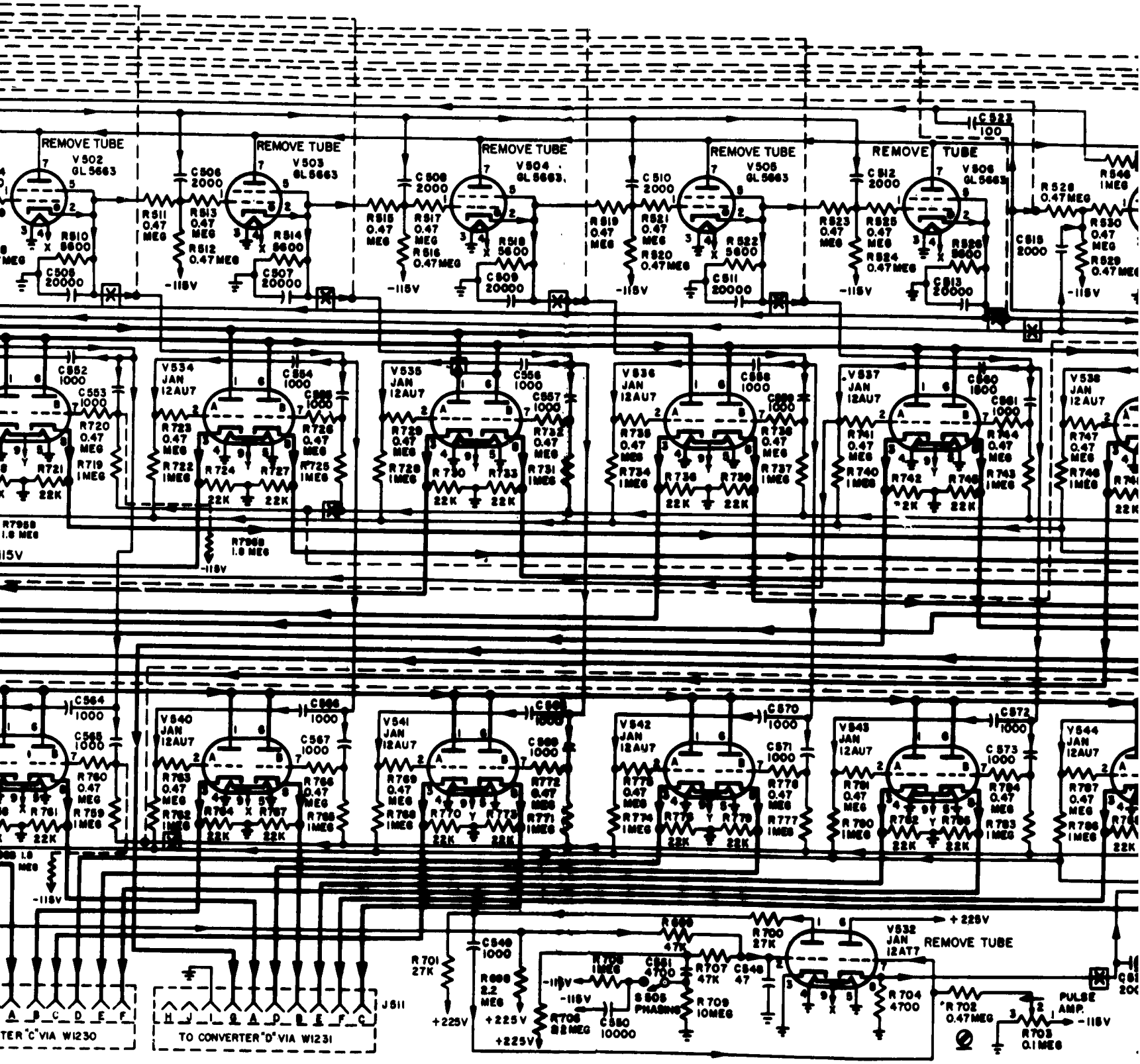
Figure 2-40. Receiving Signal Distributor TT-64/FGC-5, Unit No. 4, Modified Schematic Diagram For 8-Channel Operation



NOTES

1. RESISTANCE VALUES IN OHMS UNLESS SUFFIXED WITH "K"-KILOHMS OR "MEG"-MEGOHMS.
2. CAPACITANCE VALUES IN MICROMICROFARADS UNLESS SUFFIXED WITH "μF"-MICROFARADS.
3. "X" OR "Y" INDICATES FILAMENT LEADS TERMINATING AT J 501 CONNECTOR.
4. SECTION "A" OF MULTIPLE WAFER SWITCH IS NEARER KNOB END OF SWITCH.
5. [X] INDICATES CIRCUIT OPENED
6. CONNECTIONS SHOWN IN DASHED LINES REPRESENT ELECTRICAL MODIFICATIONS.

1


REMOVE TUBE
V502 GL5663
REMOVE TUBE
V503 GL5663
REMOVE TUBE
V504 GL5663
REMOVE TUBE
V505 GL5663
REMOVE TUBE
V506 GL5663
C506 2000
C508 2000
C510 2000
C512 2000
C523 100
R511 0.47 MEG
R513 0.47 MEG
R512 0.47MEG
R515 0.47 MEG
R517 0.47 MEG
R516 0.47MEG
R519 0.47 MEG
R521 0.47 MEG
R520 0.47MEG
R523 0.47 MEG
R525 0.47 MEG
R524 0.47MEG
R528 0.47MEG
R530 0.47 MEG
R529 0.47MEG
R510 5600
R514 5600
R518 5600
R522 5600
R526 5600
C505 20000
C507 20000
C509 20000
C511 20000
C513 20000
C515 2000
-115V
V534 JAN 12AU7
V535 JAN 12AU7
V536 JAN 12AU7
V537 JAN 12AU7
V538 JAN 12AU7
C552 1000
C553 1000
C554 1000
C555 1000
C556 1000
C557 1000
C558 1000
C559 1000
C560 1000
C561 1000
R720 0.47 MEG
R721 1MEG
R723 0.47 MEG
R722 1MEG
R726 0.47 MEG
R725 1MEG
R729 0.47 MEG
R728 1MEG
R732 0.47 MEG
R731 1MEG
R735 0.47 MEG
R734 1MEG
R738 0.47 MEG
R737 1MEG
R741 0.47 MEG
R740 1MEG
R744 0.47 MEG
R743 1MEG
R747 0.47 MEG
R746 1MEG
22K
R7958 1.8 MEG
V540 JAN 12AU7
V541 JAN 12AU7
V542 JAN 12AU7
V543 JAN 12AU7
V544 JAN 12AU7
C564 1000
C565 1000
C566 1000
C567 1000
C568 1000
C569 1000
C570 1000
C571 1000
C572 1000
C573 1000
R760 0.47 MEG
R761 1MEG
R763 0.47 MEG
R762 1MEG
R766 0.47 MEG
R765 1MEG
R769 0.47 MEG
R768 1MEG
R772 0.47 MEG
R771 1MEG
R775 0.47 MEG
R774 1MEG
R778 0.47 MEG
R777 1MEG
R781 0.47 MEG
R780 1MEG
R784 0.47 MEG
R783 1MEG
R787 0.47 MEG
R786 1MEG
R759 1MEG
R764 22K
R767 22K
R770 22K
R773 22K
R776 22K
R779 22K
R782 22K
R785 22K
R788 1.8 MEG
R701 27K
C540 1000
R699 2.2 MEG
+225V
R698 47K
R700 27K
V532 JAN 12AT7
REMOVE TUBE
R706 1MEG
C561 4700
R707 47K
C540 47
R708 82MEG
C560 10000
S505 PHASING
R709 10MEG
R704 4700
R702 0.47MEG
R705 0.1MEG
PULSE AMP.
J511
A B C D E F
TER "C" VIA W1230
H J I G A D B E F C
TO CONVERTER "D" VIA W1231

2

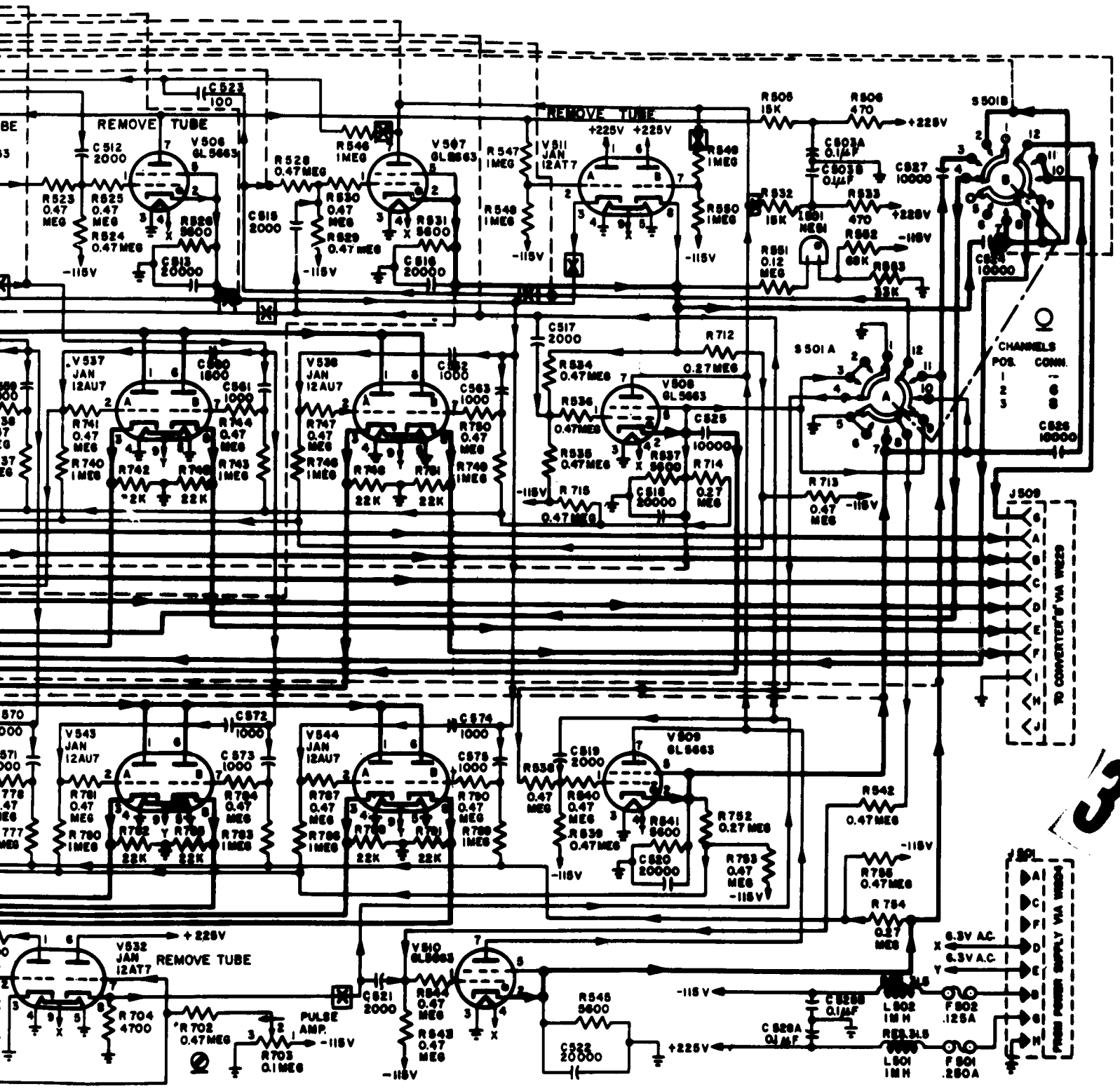
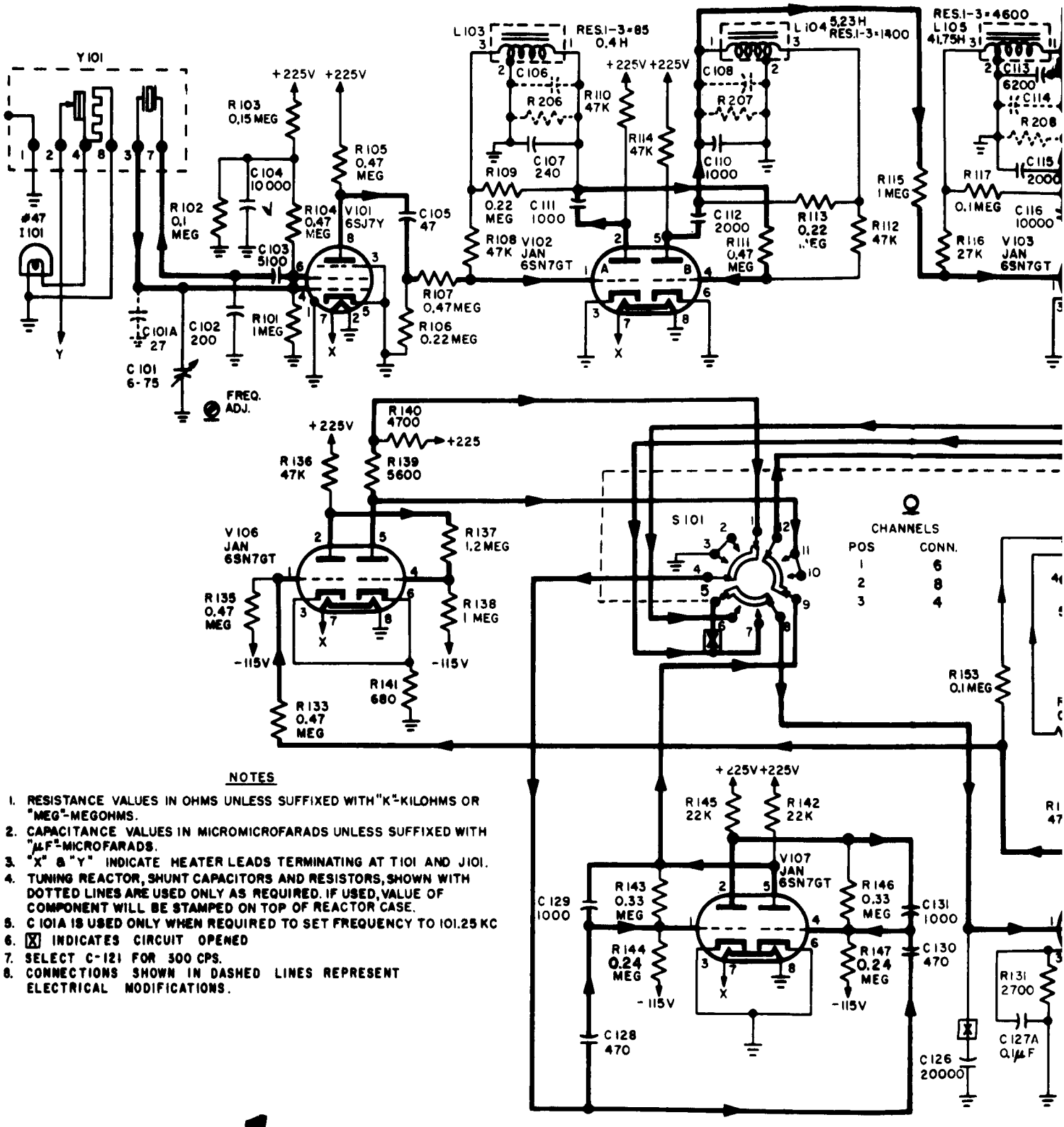


Figure 2-41. Receiving Signal Distributor TT-64/FGC-5, Unit No. 2, Modified Schematic Diagram For 8-Channel Operation



NOTES

1. RESISTANCE VALUES IN OHMS UNLESS SUFFIXED WITH "K"-KILOHMS OR "MEG"-MEGOHMS.
2. CAPACITANCE VALUES IN MICROMICROFARADS UNLESS SUFFIXED WITH "μF"-MICROFARADS.
3. "X" & "Y" INDICATE HEATER LEADS TERMINATING AT T101 AND J101.
4. TUNING REACTOR, SHUNT CAPACITORS AND RESISTORS, SHOWN WITH DOTTED LINES ARE USED ONLY AS REQUIRED. IF USED, VALUE OF COMPONENT WILL BE STAMPED ON TOP OF REACTOR CASE.
5. C 101A IS USED ONLY WHEN REQUIRED TO SET FREQUENCY TO 101.25 KC
6. [X] INDICATES CIRCUIT OPENED
7. SELECT C-121 FOR 300 CPS.
8. CONNECTIONS SHOWN IN DASHED LINES REPRESENT ELECTRICAL MODIFICATIONS.

1

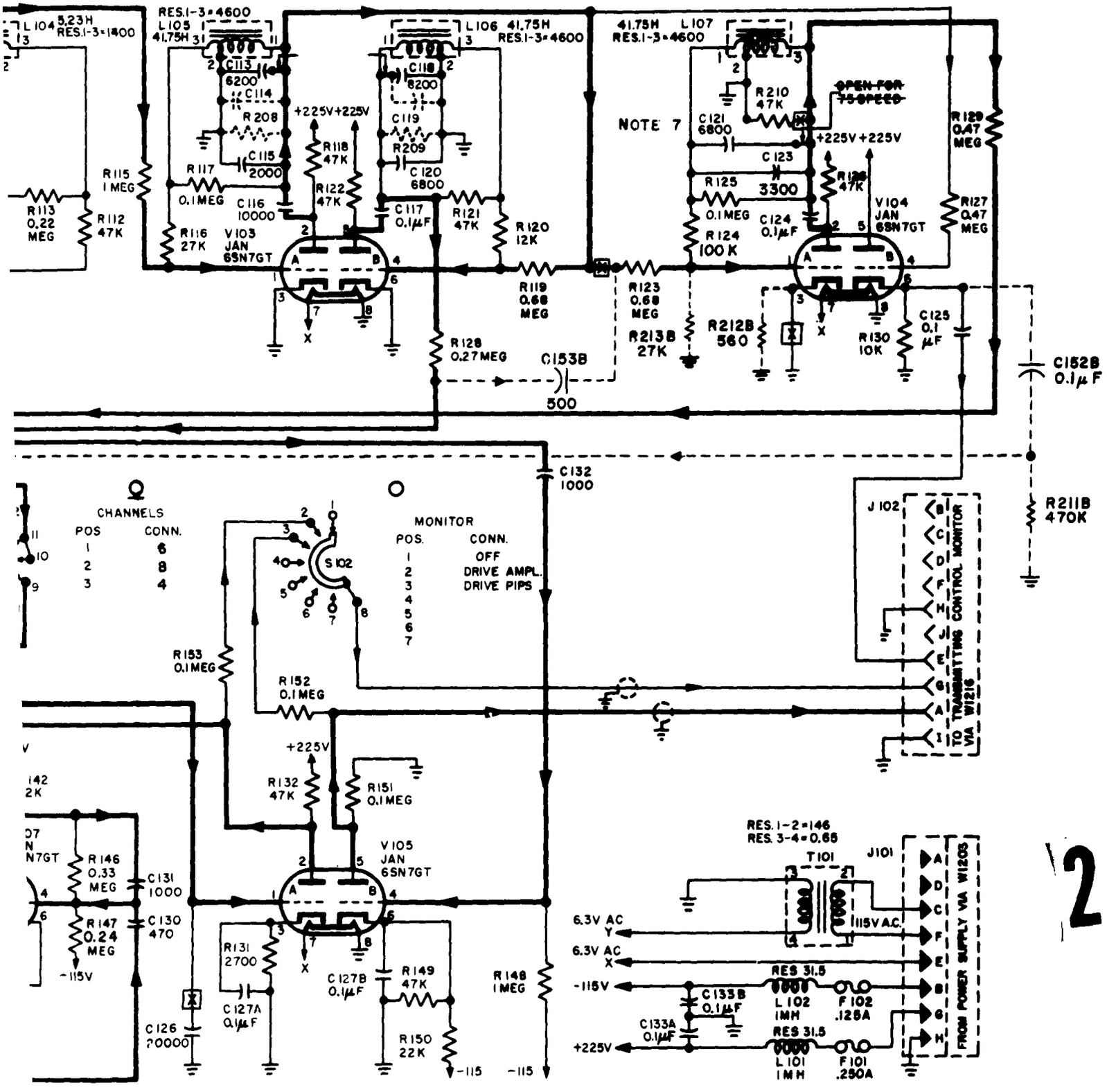
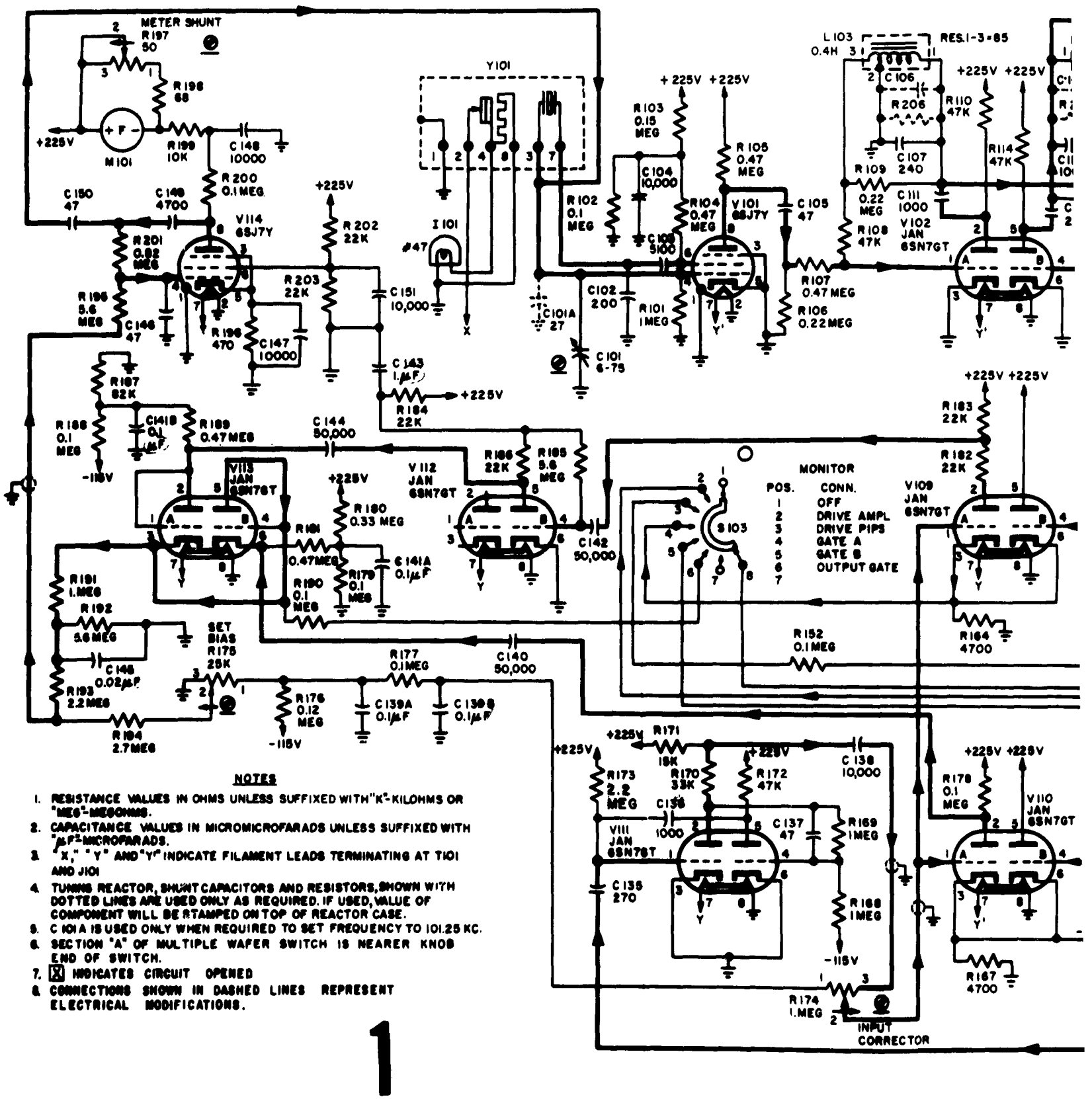


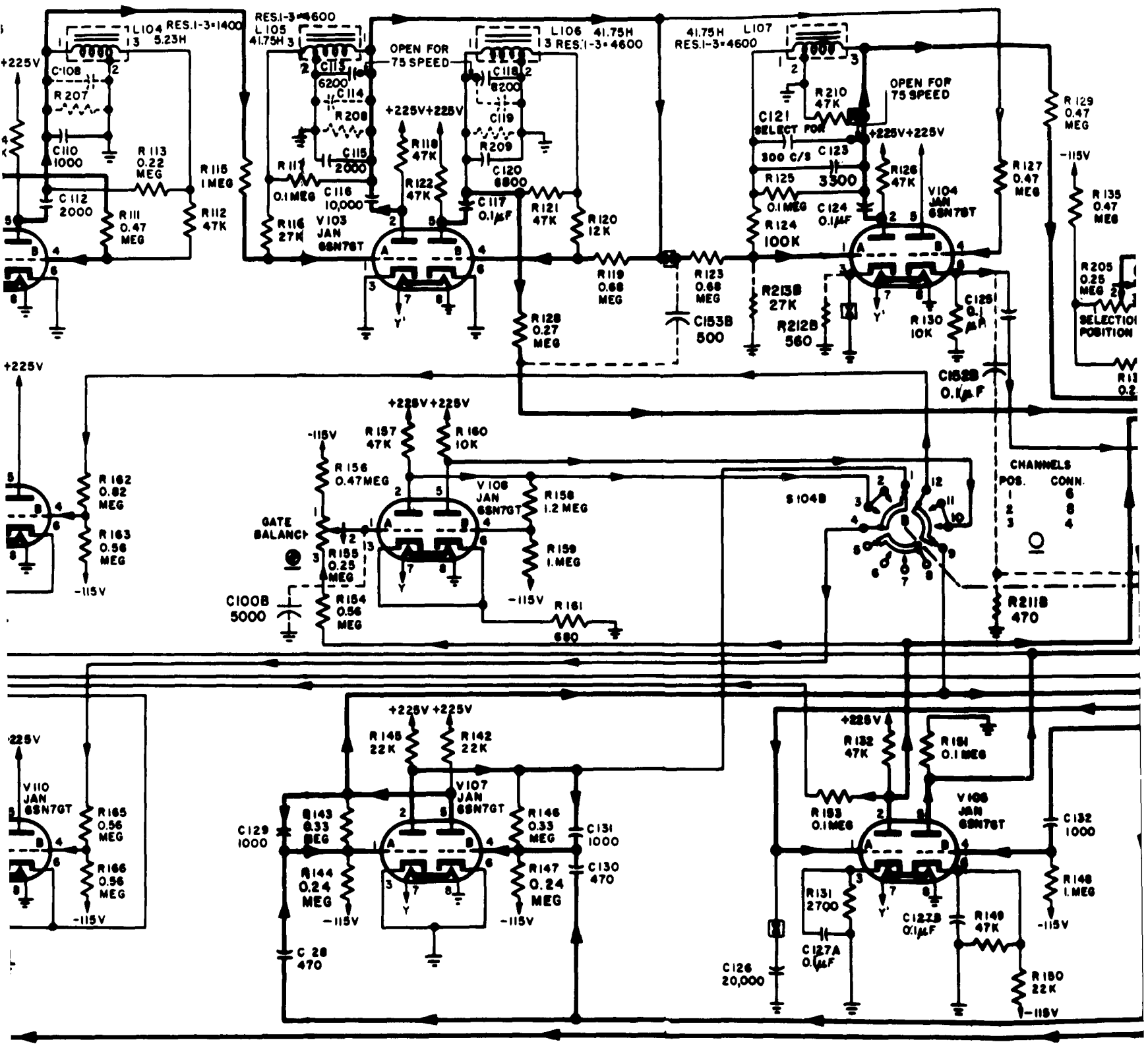
Figure 2-42. Transmitting Signal Distributor Drive O-101/FGC-5, Unit No. 1, Modified Schematic Diagram For 8-Channel Operation



NOTES

1. RESISTANCE VALUES IN OHMS UNLESS SUFFIXED WITH "K"-KILOHMS OR "MEG"-MEGOHMS.
2. CAPACITANCE VALUES IN MICROMICROFARADS UNLESS SUFFIXED WITH "μF"-MICROFARADS.
3. "X," "Y" AND "Y'" INDICATE FILAMENT LEADS TERMINATING AT T101 AND J101
4. TUNING REACTOR, SHUNT CAPACITORS AND RESISTORS, SHOWN WITH DOTTED LINES ARE USED ONLY AS REQUIRED. IF USED, VALUE OF COMPONENT WILL BE STAMPED ON TOP OF REACTOR CASE.
5. C 101A IS USED ONLY WHEN REQUIRED TO SET FREQUENCY TO 101.25 KC.
6. SECTION "A" OF MULTIPLE WAFER SWITCH IS NEARER KNOB END OF SWITCH.
7. ☒ INDICATES CIRCUIT OPENED
8. CONNECTIONS SHOWN IN DASHED LINES REPRESENT ELECTRICAL MODIFICATIONS.

1


L104 RES.1-3-1400 5.23H
L105 RES.1-3-4600 41.75H
L106 41.75H RES.1-3-4600
L107 41.75H RES.1-3-4600
+225V
C108
R207
C110 1000
R113 0.22 MEG
R115 1 MEG
C112 2000
R111 0.47 MEG
R112 47K
C115 6200
C114
R208
C115 2000
R111 0.1 MEG
C116 10,000
R116 27K
V103 JAN 6SN7GT
OPEN FOR 75 SPEED
+225V+225V
R118 47K
R122 47K
C118 8200
C119
R209
C120 6800
C117 0.1µF
R121 47K
R120 12K
R119 0.68 MEG
R123 0.68 MEG
C153B 500
R128 0.27 MEG
R210 47K
C121 SELECT FOR
300 C/S
C123
R125 3300
0.1 MEG
C124 0.1µF
R124 100K
R126 47K
V104 JAN 6SN7GT
R213B 27K
R212B 560
R130 10K
C125 0.1µF
C152B 0.1µF
R129 0.47 MEG
R127 0.47 MEG
-115V
R135 0.47 MEG
R205 0.25 MEG
SELECTION POSITION
R162 0.82 MEG
R163 0.56 MEG
-115V
R157 47K
R160 10K
R156 0.47MEG
V108 JAN 6SN7GT
R158 1.2 MEG
GATE BALANCE
R155 0.25 MEG
R159 1.MEG
C100B 5000
R154 0.56 MEG
R161 680
S104B
CHANNELS
POS.
CONN.
R211B 470
V110 JAN 6SN7GT
R165 0.56 MEG
R166 0.56 MEG
R145 22K
R142 22K
V107 JAN 6SN7GT
C129 1000
R143 0.33 MEG
R146 0.33 MEG
C131 1000
R144 0.24 MEG
R147 0.24 MEG
C130 470
C 28 470
R132 47K
R151 0.1 MEG
R153 0.1 MEG
V106 JAN 6SN7GT
C132 1000
R131 2700
C127A 0.1µF
C127B 0.1µF
R149 47K
R148 1.MEG
C126 20,000
R150 22K

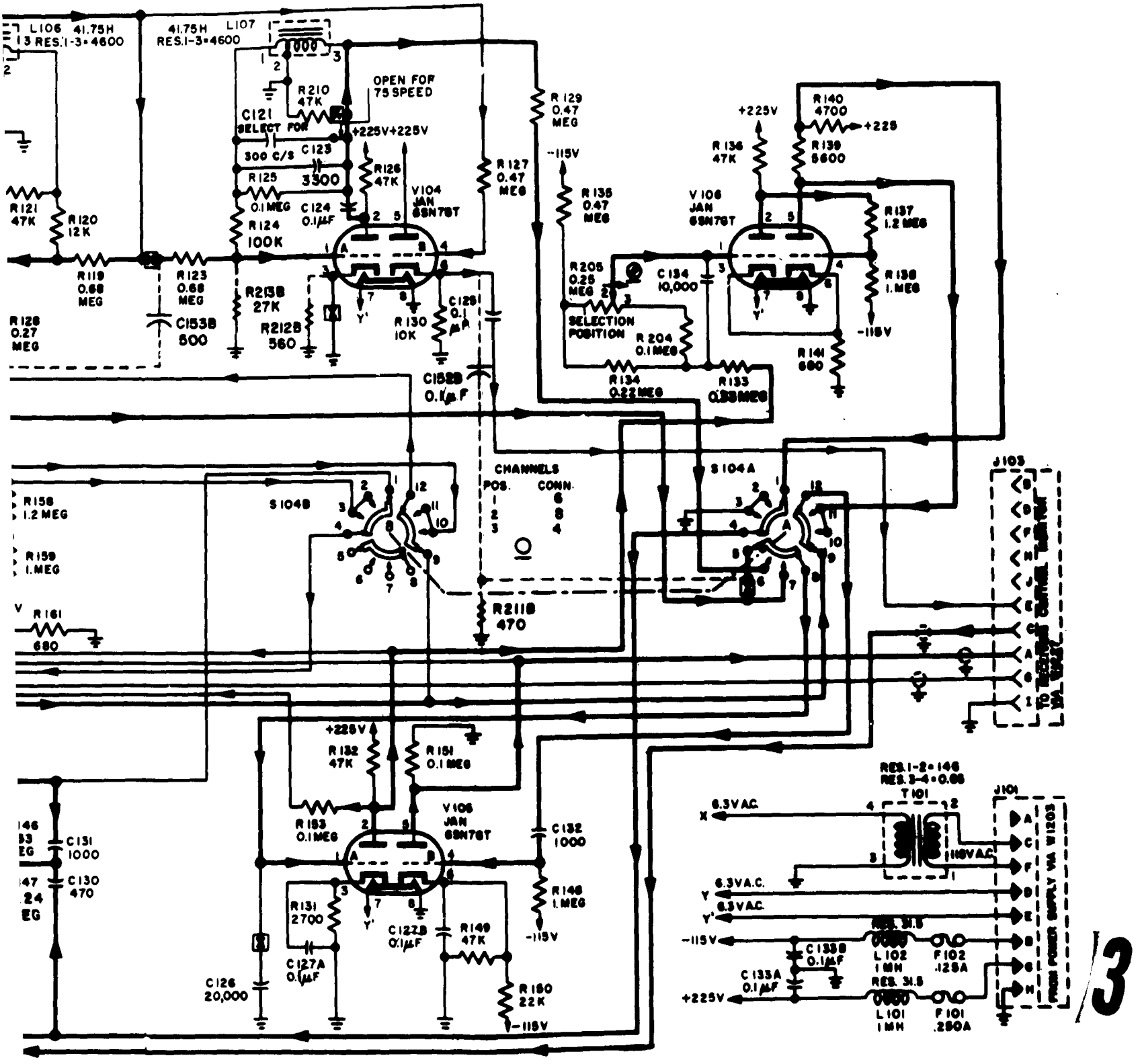


Figure 2-43. Receiving Signal Distributor Drive O-100/FGC-5, Unit No. 1, Modified Schematic Diagram For 8-Channel Operation

3. FSK-2 MODIFICATIONS

3.1 General Description

3.1.1 Decision Threshold Computer Modification. In the conventional FSK detector, the signals from filters tuned to the mark and space frequencies are compared, and the mark-space decision is made on the basis of the larger signal amplitude. If the received signal is subject to flat fading, this system performs well; but with frequency-selective fading, as is commonly observed on ionospheric-scatter paths, the system may be subject to high error rates.

The transmitted signal may be considered to be two AM signals, each carrying the transmitted information. Since the full message is available on each frequency, failure need not occur unless both signals fade simultaneously. With 6-kc separation between mark and space signals, as employed in the modified FSK-2 system, fading does not always occur simultaneously. A frequency-diversity advantage is therefore possible. The decision threshold computer* achieves this diversity advantage, i.e., dual-AM diversity from a single receiver, by shifting the decision threshold. This is accomplished by separately storing mark and space amplitude information and deriving from this the optimum threshold level.

When the decision threshold computer is operated in the MARK position, the receiver becomes, in effect, an AM receiver operating on the frequency of mark signals only. The space signal is ignored by the decision threshold computer, and the resultant intelligence is translated from unipolar to bipolar keying to actuate the remaining circuitry of the combiner. In this way, disruptive interference which occurs on the space frequency can be avoided at the expense of a slight degradation of normal performance. For reception in the SPACE position, the converse of the above applies.

3.1.2 Ratio-Squared Combining Modification. Improved diversity performance results when the signals from the individual channels are weighted according

* Page Patent No. 2,999,925

to their signal-to-noise ratio prior to addition. A channel with a high signal-to-noise ratio can thereby contribute proportionately more to the combined signal than a channel with a lower signal-to-noise ratio. Weighting of contributions of two or more signals in proportion to the square of their signal-to-noise ratios permits the lesser signal or signals to contribute most effectively to the signal-to-noise ratio of the combined output. The modification installed in the FSK-2 receiver approximates the desired ratio-squared characteristic.

3.2 Modification Instructions

3.2.1 Decision Threshold Computer

(1) Disconnect all interchassis cables from the rear of the combiner chassis. Remove the chassis from the rack; then remove the tubes from the chassis.

(2) Use Figure 3-1 as a template to locate the four mounting holes and the grommet hole, and centerpunch the locations. The vertical centerline of Figure 38 should be 5-inches from the left of the chassis, measured to the inside of the hinged frame.

(3) Remove the rear cover of the combiner chassis, and remove the screws holding connector brackets TB-501 and TB-502 and terminal board TB-504. It is necessary to unsolder one end of C-504 to reach one of the screws holding TB-504. TB-504 may be moved aside to permit drilling the mounting hole beneath it.

CAUTION:

The precision resistors on S-501 are easily damaged. They should be handled with care.

(4) Drill the four mounting holes, using a No. 16 drill. Be careful to avoid damaging components underneath the chassis. The grommet hole is drilled first with a No. 16 drill, then with a 3/8-inch drill.

(5) Loosen S-501 by removing the two screws in the mounting brackets at each end of the switch and the two screws supporting the right-angle drive. Do not loosen the flexible coupling between the switch and the right-angle drive.

(6) Insert the 3/8-inch grommet in the hole in the combiner chassis and feed through the leads from the Decision Threshold Computer (DTC).

(7) Insert the mounting screws (8-32 x 1/2 inch) from the front, using an internal-tooth washer under the screw head and an external-tooth washer under the nut.

(8) Remove R-534 (100K) between pins 3 and 7 of XV-502. See Figure 3-3.

(9) Remove R-552, the 1.5K potentiometer.

(10) Remove R-541, 5.1K, on TB-505.

(11) Connect a 1.5K, 1/2 W resistor (new R-552) from R-531 to pin 3 of XV-502.

(12) Mount a 10K, 2W potentiometer (new R-541) on the bracket from which R-552 was removed, with the terminals upward. The right terminal should be connected to pin 8, XV-502. The left and center terminals are connected together and to ground at the lower terminal on TB-505, where the original R-541 was formerly connected. The 10K potentiometer is designated R-541 to conform to the FSK-2 designation.

(13) Connect the yellow lead from the DTC to pin 3 of XV-502, and the orange lead to pin 7.

(14) Lace the remaining wires together and dress them around the side of the chassis to the lower right corner.

(15) Connect the power leads to the lugs below terminal strip TB-501. The red wire is B+, black is ground, white is B-, and brown is the heater.

(16) Remove the wire connecting R-507 to R-508, on TB-503, and the wire from R-507 to pin 2 of XV-501.

(17) Connect the blue wire to the right side of R-507 and the violet wire to the right side of R-508. The green wire goes to XV-501, pin 2.

(18) Reconnect C-504, S-501, TB-501, and TB-502. Replace the chassis in the rack, reconnect interchassis wiring, and replace the tubes.

3.2.2 Ratio-Squared Combiner

(1) Disconnect at the connector end the two wires running from BNC connectors J-501 through J-506 to R-507 and R-508. Remove the shorting buss wires between R-501, R-502, and R-503, and between R-504, R-505, and R-506.

(2) Drill two No. 30 or 1/8-inch holes in BNC connector bracket TB-502. Locate these holes in line with J-503 and J-504, and 1/2-inch from the front edge of the bracket. Countersink these holes from the side next to the chassis.

(3) Mount the two standoff terminals on the bracket, using 4-40 x 1/4-inch flat-head screws and external-tooth lock washers.

(4) Connect J-503 and J-504 to the adjacent standoff terminals.

(5) Connect R-585, a 270K resistor, between J-501 and the standoff near J-503, and R-586, another 270K resistor, between J-502 and the same standoff.

(6) Connect R-587, a 270K resistor, between J-505 and the standoff near J-504, and R-588, another 270K resistor, between J-506 and the same standoff.

(7) Connect the wire from R-507 to the standoff near J-503 and the wire from R-508 to the standoff near J-504.

(8) Drill two No. 27 or 9/64-inch holes in the rear cover of the combiner chassis, 7/16-inch above the cutout for the BNC connectors and 2-15/16 inches and 3-11/16 inches, respectively, from the right side of the cover.

(9) Mount the receptacle cover bracket on the combiner chassis cover, using machine screws, with an internal-tooth washer under the screw head and an external-tooth washer under the nut. Position the bracket to cover J-503 and J-504 when the chassis cover is installed. See Figure 3-2.

(10) In the 50-kc IF amplifier chassis of each bay, replace R-338 and R-356 (1M, 1/2W) with 470K, 1/2W resistors. See Figure 3-4.

(11) In the 50-kc IF amplifier chassis of each bay, remove C-344 and C-345, 470 μμf, which were connected across the mark and space output connectors, J-303 and J-305, respectively.

3.3 Operation and Adjustment of the Modified Receiver

3.3.1 Initial Adjustment of Decision Threshold Computer

(1) Remove V-301 from the 50-kc IF amplifier chassis in each receiver connected to the combiner. With the internal test meter connected to TP-510 on the DTC and with the DTC function switch in either NORMAL or BYPASS position, adjust R-580 for a zero reading. Lock R-580, being careful not to change the zero adjustment. Adjust the balance control potentiometer R-541 so that the Schmitt trigger is in the middle of its operating range and has equal probability of switching to either of its stable conditions. Physically, this is accomplished by moving R-541 in one direction slowly and noting the point at which the Schmitt trigger switches, as indicated by the neon lamps. Rotate R-541 in the opposite direction until the Schmitt trigger switches to the

other stable state. Set R-541 as close as possible to a point in the center of the two points at which the trigger switched.

(2) Remove the input signal cables from the combiner. Set the filter bandwidth switch at 250 cps. Ground J-501 (mark input) and J-506 (space input). Measure the following voltages with the DTC function switch in the indicated position. (Measure C-514 at pin K and C-515 at pin J of J-507.)

Switch Position	V-506 pin 2	TP-510	C-514	C-515	Junction of R-582, R-583, R-584
BYPASS	2.5 ±1V	0 ± 0.25V	0 ±0.25V	0 ±0.25V	2.5 ± 2V
NORMAL	2.5 ±1V	0 ± 0.25V	0 ±0.25V	0 ±0.25V	2.5 ± 2V
MARK	-4.0 ±2V	-5 ± 0.75V	-5 ±0.75V	-0.6±0.1V	Note 1
SPACE	+8.0 ±2V	+5± 0.75V	+0.6±0.1V	+5 ±0.75V	Note 2

Note 1: This voltage must be 4± 0.7 volts less than the voltage measured at the same point in the NORMAL position.

Note 2: This voltage must be 4±0.7 volts greater than the voltage measured at the same point in the NORMAL position.

(3) Remove the ground from J-501, and connect an audio oscillator to J-501. The oscillator should be set at 15V rms at 300 cps. Set the DTC function switch in the NORMAL position. Connect the dc oscilloscope to V-502, pin 7, and center the signal on the oscilloscope screen. When the DTC is switched to the MARK position, the signal should deflect momentarily and return to the center of the screen. When the switch is turned to the SPACE position, a positive dc voltage will result.

(4) Ground J-501 and connect the oscillator to J-506, again setting it at 15V rms, 300 cps. Center the oscilloscope trace with the DTC function switch in the NORMAL position as before. When the switch is turned to the SPACE position, the trace should deflect momentarily and return to center. When the switch is turned to the MARK position, a negative dc voltage will result.

(5) If the voltages and waveforms are as described above, the DTC is functioning normally. If the voltages are not within the prescribed ranges, they may indicate that V-506 is defective. In the event that the voltage measurements are satisfactory and the waveforms are unsatisfactory, decision network Z-501 should be replaced.

3.3.2 Operation on 4, 6, or 8 Channels

3.3.2.1 DTC Operating Instructions. After it has been ascertained that the DTC is functioning properly, it should be operated in the NORMAL position except under the following conditions:

(1) When the system is operating in conjunction with antimultipath equipment, the DTC is operated in the BYPASS position.

(2) When interference is present on the space frequency, and other available measures for avoiding such interference fail, the DTC may be operated in the MARK position. The SPACE position may be used to avoid interference on the mark frequency. System performance is somewhat degraded in this mode of operation, compared with operation using both signals. The mark and space modes should, therefore, be used only as a last resort, and the DTC should be returned to NORMAL as soon as conditions permit.

3.3.2.2 50-KC IF and Combiner Switching

(1) The predetection filter straps on TB-302 and TB-303 in both 50-kc IF amplifiers should be removed for 4, 6, or 8-channel operation.

(2) For 4 or 6-channel operation, S-501 on the combiner chassis should be set for 150 cps.

(3) For 8-channel operation, S-501 should be set for 250 cps.

(4) Since the equipment will normally be used in the 8-channel mode, the adjustments described below should be made with the postdetection filter switch set for 8-channel operation. Should it be necessary to reduce channels temporarily, the postdetection filter switch should be set accordingly.

3.3.3 Receiver Alignment Procedures. Perform the adjustments below after having performed the alignments given in paragraphs 1a through 1f, Section III, of PCE-M-4315, "Supplement to the Instruction Book for the FSK-2 Dual-Diversity Receiving and Excitation Equipment." In addition, substitute the material given below for paragraphs 1g and 1h, Section III, of PCE-M-4315.

> "g. Adjusting the Mark-Space Adjustoroids. Adjustoroids Z-303 and Z-304 in the 50-kc amplifier and Z-1202 and Z-1203 in the recorder-amplifier must now be tuned to the mark and space carrier frequencies. This is a front-panel adjustment and the AVE SIGNAL STRENGTH and the COMBINED IF OUTPUT meters are used as peaking indicators.
>
> (1) Adjust the FREQ control on the test signal generator until the MARK lamp on Bay 1 metering panel lights, and maximum deflection of the TUNING INDICATOR meter is achieved. A slight correction of TUNING VERNIER control C-414 might be necessary at this point.
>
> (2) Note the deflection of the AVE SIGNAL STRENGTH meter; adjust the AGC LOOP GAIN control for deflection in the first third of the meter scale.
>
> (3) Adjust Z-304 (the bottom adjustoroid) on the 50-kc IF amplifier panel for a peak on the COMBINED IF OUTPUT meter.
>
> (4) Adjust Z-1202 (the bottom adjustoroid) on the recorder-amplifier panel for a peak on the AVE SIGNAL STRENGTH meter.
>
> (5) Adjust the FREQ control of the test signal generator until the SPACE lamp on Bay 1 metering panel lights, and there is maximum deflection of the TUNING INDICATOR meter.
>
> (6) Readjust the AGC LOOP GAIN, if necessary, for proper AVE SIGNAL STRENGTH meter deflection.

(7) Adjust Z-303 (the top adjustoroid) on the 50-kc IF amplifier panel for the peak on the COMBINED IF OUTPUT meter.

(8) Adjust Z-1203 (the top adjustoroid) on the recorder-amplifier panel for a peak on the AVE SIGNAL STRENGTH meter.

h. Aligning the Units in Bay 2. All units in Bay 2, with the exception of the recorder-amplifier (already aligned), must be aligned in a manner identical to that used for Bay 1. The control designations (e. g. , C-101, C-414, etc.) in Bay 2 refer to parts identical to those in Bay 1. The recorder-amplifier in conjunction with the AVE SIGNAL STRENGTH, TUNING INDICATOR, and COMBINED IF OUTPUT meters, was used to aid in the alignment of Bay 1 components. It is now necessary to connect the recorder-amplifier 2. 2-mc input to the Bay 2 converter-amplifier 2. 2-mc IF output (J-204) for alignment of Bay 2.

(1) Disconnect the rf cable from J-204 at the rear of the converter unit in Bay 1.

(2) Connect the rf cable to J-204 at the rear of the converter-amplifier unit in Bay 2.

NOTE:

It is necessary to cross-connect the TUNING INDICATOR circuit in the lf oscillator for use with the 50-kc amplifier in Bay 2.

(3) Disconnect the rf cables at J-404 and J-405 in the lf oscillator in Bay 1. With two rf cables of sufficient length terminated with BNC male connectors, connect J-304 in Bay 2 to J-404 and connect J-302 in Bay 2 to J 405.

(4) Proceed with the alignment of Bay 2 as described in paragraphs 1a through 1e, and 1g, (1), (2), (3), (5), (6), and (7) above.

(5) After completion of the alignment of the equipments in Bay 2, restore the recorder-amplifier 2. 2-mc input connection to J-204 at the rear of the converter-amplifier in Bay 1. Disconnect the lf oscillator

50-kc IF amplifier cross-connections made in step (3) above, and restore the connections from J-305 to J-404 and from J-302 to J-405 in Bay 1."

3.3.4 Receiver Final Adjustments. Perform the adjustments below after having performed the adjustments given in paragraphs 2a and 2b, Section III, of PCE-M-4315, "Supplement to the Instruction Book for the FSK-2 Dual-Diversity Receiving and Excitation Equipment." In addition, substitute the material given below for paragraphs 2c and 2d, Section III, of PCE-M-4315.

"c. Final Mark-Space Balance Adjustment with Cosmic Noise Input to Dual-Diversity Receiving System.

NOTE:

The distant terminal carrier must be off for these adjustments. If this is impossible because of operational reasons, the alternate or noise-break frequency can be used provided it is clean of interference from distant or local carriers or cross-modulation products. S-502, Decision Threshold Computer Switch, must be in NORMAL position.

(1) Remove V-301 in the 50-kc IF amplifier chassis in each bay.

(2) With the internal test meter connected to TP-510 on the DTC and the DTC function switch, S-502, in the NORMAL position, adjust R-580 for a zero reading. Lock R-580, being careful not to change the setting.

(3) Adjust the balance control, R-541, so that the Schmitt trigger is in the middle of its operating range, and has equal probability of switching to either of its stable conditions. This is accomplished by moving R-541 in one direction until the Schmitt trigger switches to the other stable state. Set R-541 as close as possible to a point in the center between the two points at which the trigger switched.

(4) Replace V-301 in each bay being careful that the two tubes are not interchanged.

(5) With an oscilloscope connected alternately at TP-305 and TP-308 on either bay, monitor both 50-kc IF channels for the presence of interference from distant or local carriers or for cross-modulation products, or for the presence of excessive noise from local sources. Before the following steps can be accomplished, the IF channels must be absolutely free from any abnormal noise or carriers whatsoever.

(6) Adjust the 50-kc IF amplifier GAIN control (R-301) on each bay for a reading of 5 microamperes on the COMBINED IF OUTPUT meter at the top of each bay to establish optimum 50-kc IF gains with respect to cosmic-noise intensity.

(7) Disconnect the rack cables W-2310 and W-2408 from the input connectors J-301 on each bay of the receiver at the rear of the 50-kc IF amplifier units.

(8) Insert the lead of the TEST METER in TP-501 of the combiner unit.

CAUTION:

Never connect the TEST METER to TP-501 and TP-510 when carriers (normal or interfering) are visible in the IF test points TP-305 and TP-308. No balance adjustments should ever be attempted under signal conditions.

(9) Note the static reading of the TEST METER. If conditions are normal, deflection will hover around meter zero.

NOTE:

When noting the meter zero, watch for kicks or vibration of the TEST METER pointer. Such movement can indicate oscillation or mutual coupling interference, or excessive noise through the IF amplifier stages. These are all undesirable conditions and must be corrected at once.

(10) Reconnect the signal input connector (cord W-2310) at J-301 of the 50-kc IF amplifier in Bay 1. (See Fig. 3-17.)

(11) Observe the TEST METER which is connected at TP-501 of the combiner. The pointer should be fluctuating slightly on cosmic noise, with an average reading of zero as noted in step (9) above.

(12) If the average reading is more than plus or minus 2 microamperes from zero, correct the mark-space balance with a careful adjustment of either the 47-kc or 53-kc BAL control, whichever control brings the reading to average exactly zero. This is done only by reducing (rotating the BAL control counterclockwise) the gain of the mark or space channel. If the average indication is to the right of zero, reduce the 53-kc BAL control; if it is to the left, reduce the 47-kc BAL control. Never increase (rotate clockwise) either BAL control to achieve the zero average reading.

CAUTION:

If more than a +5-microamperes unbalance is shown to exist when step (12) is begun, a severe mark-space unbalance condition is indicated and must be corrected by trouble shooting or realignment of the 2. 2-mc and/or 50-kc tuned circuits, as described in this supplement. Refer to para. 1d and 1e of Section III. Mark-space balance of all tuned circuits ahead of the limiter (V-302) is essential, and excessive compensation by use of the BAL controls will result in severe receiver performance degradation.

(13) Disconnect the signal input cable (cord W-2310) from J-301 of the 50-kc IF amplifier in Bay 1. Connect the signal input cable (cord W-2408) associated with Bay 2 to J-301 of the 50-kc IF amplifier of Bay 2.

(14) Proceed as in steps (10) through (13) above to obtain zero average indication of cosmic noise, observing all notes and cautions for this bay as in Bay 1.

NOTE:

Step (14) completes the mark-space balance adjustments on cosmic noise for both bays of the dual-diversity receiver. Mark-space BAL controls R-322 and R-320 should not be further readjusted or disturbed. They must be carefully locked, making certain that the locking operation does not disturb their settings.

(15) Reconnect the signal input cable (cord W-2310) to J-301 of the 50-kc IF amplifier in Bay 1.

(16) With cosmic noise still the only input to the receiving system, readjust GAIN control R-301 in each bay, if necessary, to restore exactly the 5-microampere indication on the COMBINED IF OUTPUT meter.

d. Diversity-Balance Adjustment. (See Fig. 3-18.) With the mark-space balance adjustments of the above steps completed, it is necessary to insure that close diversity balance between the two receiving systems is maintained. The only controls to be adjusted are the two 50-kc IF amplifier GAIN controls (R-301). Proceed as follows:

(1) With the TEST METER still connected at TP-510, and with only a cosmic noise input to the receiving system, remove tube V-304 from the 50-kc IF amplifier in Bay 1 and tube V-307 from the 50-kc IF amplifier in Bay 2.

CAUTION:

Mark these tubes, immediately upon removal from the sockets, with marking tape identifying which came from Bay 1 and which from Bay 2 so that they will not inadvertently be interchanged when they are replaced.

(2) Observe the TEST METER. The average indication on cosmic noise should be zero.

(3) If the average of the meter pointer fluctuations is a reading more than 5 microamperes removed in either direction from the zero reading, adjust the 50-kc

IF amplifier GAIN control R-301 of either receiver very slightly until the fluctuating TEST METER pointer average equals the zero reading.

(4) As a final check of both diversity balance and mark-space balance, restore V-304 and V-307 to their original sockets. Remove V-304 from Bay 2 and V-307 from Bay 1.

(5) The meter zero average indication on cosmic noise should now be obtained on the TEST METER without further adjustment of any kind. If not, then all mark-space balance and the diversity balance procedures must be repeated until satisfactory mark-space balance and diversity balance are obtained.

(6) Replace V-304 in Bay 2 and V-307 in Bay 1.

CAUTION:

Do not interchange these tubes when replacing. They must be returned to the same socket from which individually removed.

(7) Remove the jumper between AGC and GND terminals at the terminal board (TB-1201) on the rear of the recorder amplifier chassis. Replace the rear cover of the combiner and secure the rack catch of the combiner. Remove the test lead of the TEST METER from TP-510.

(8) With all receiver-system signal cables connected for normal operation and only cosmic noise being received, check the COMBINED IF OUTPUT meter readings for both bays. They should be at 5-microamperes."

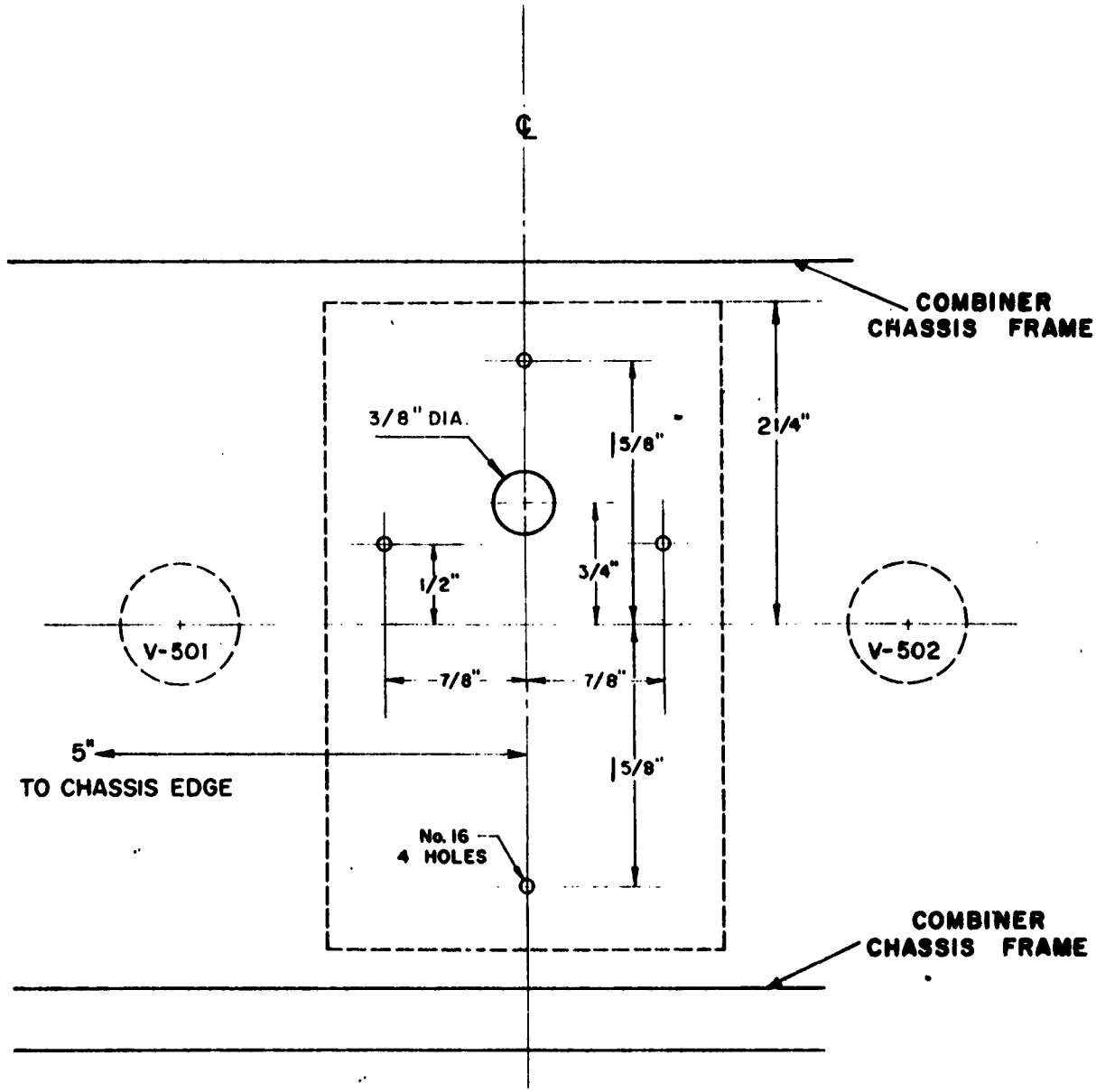


Figure 3-1 Decision Threshold Computor Mounting Template

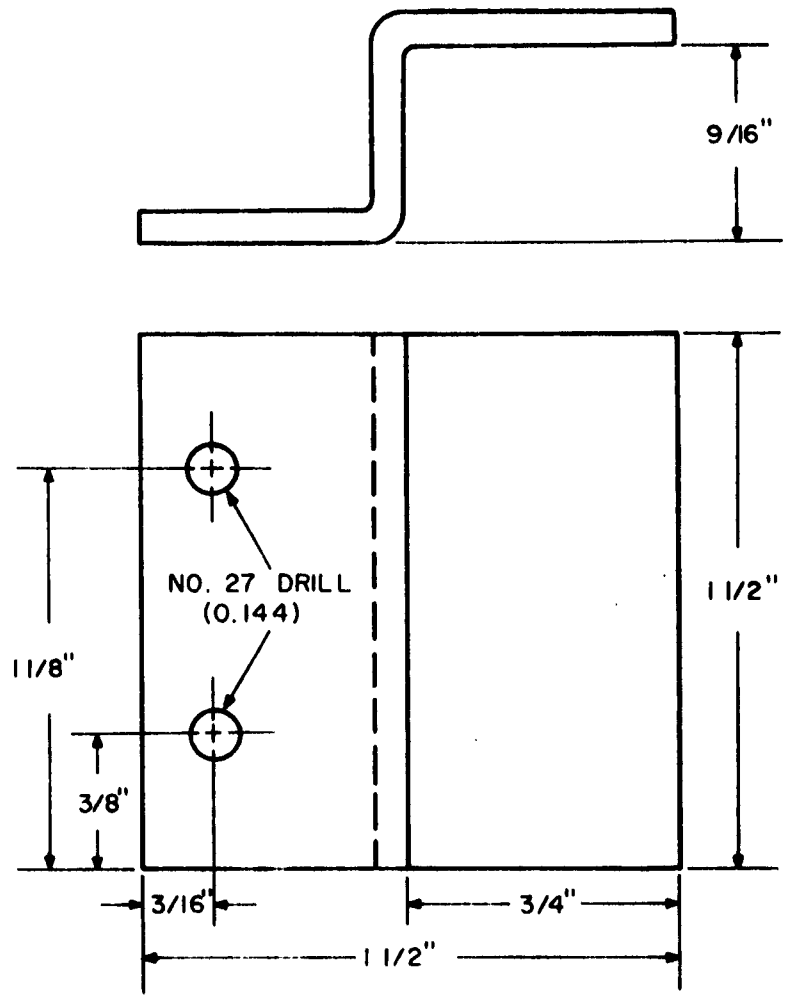
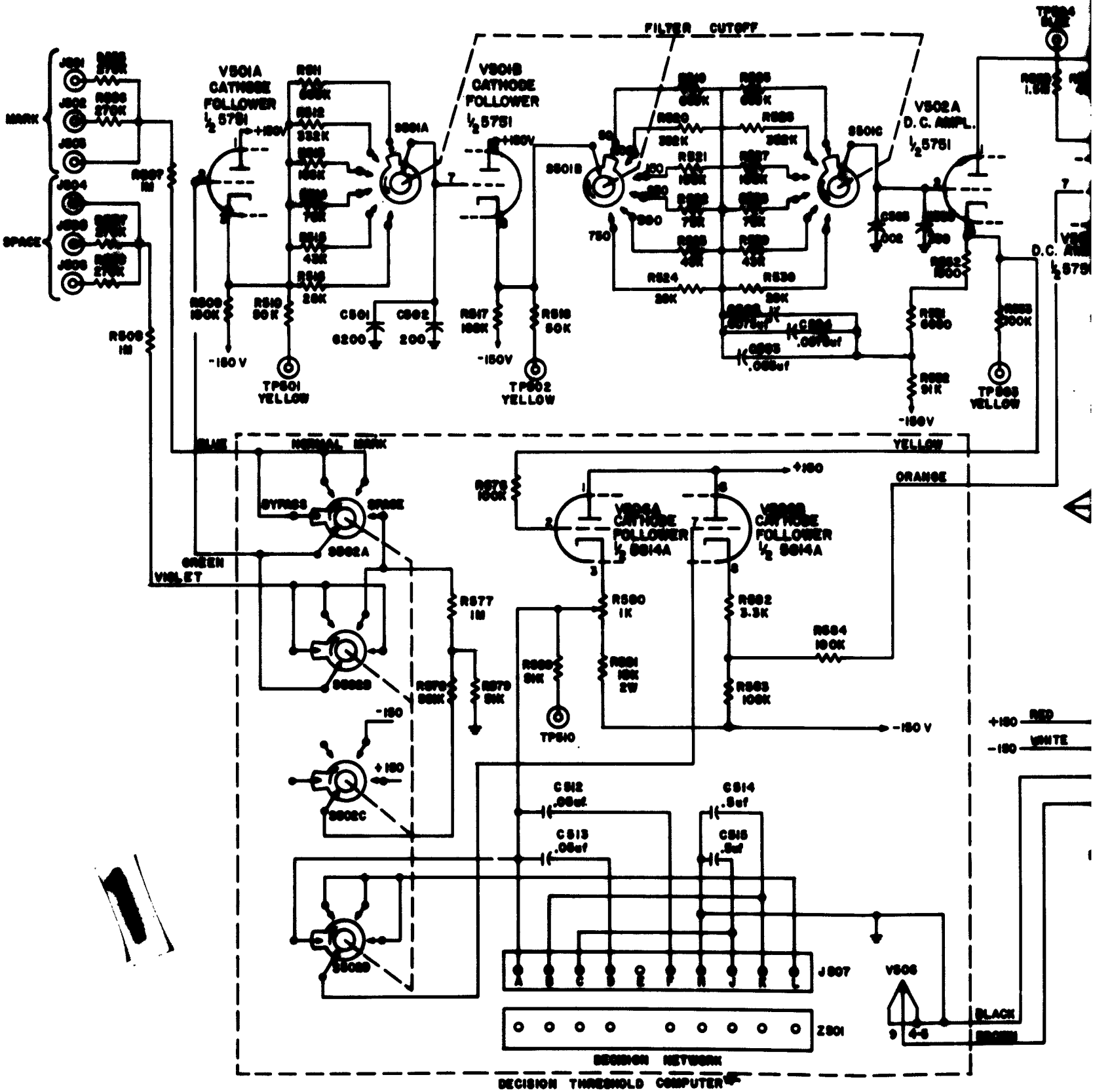


Figure 3-2 Bracket, Receptacle Cover



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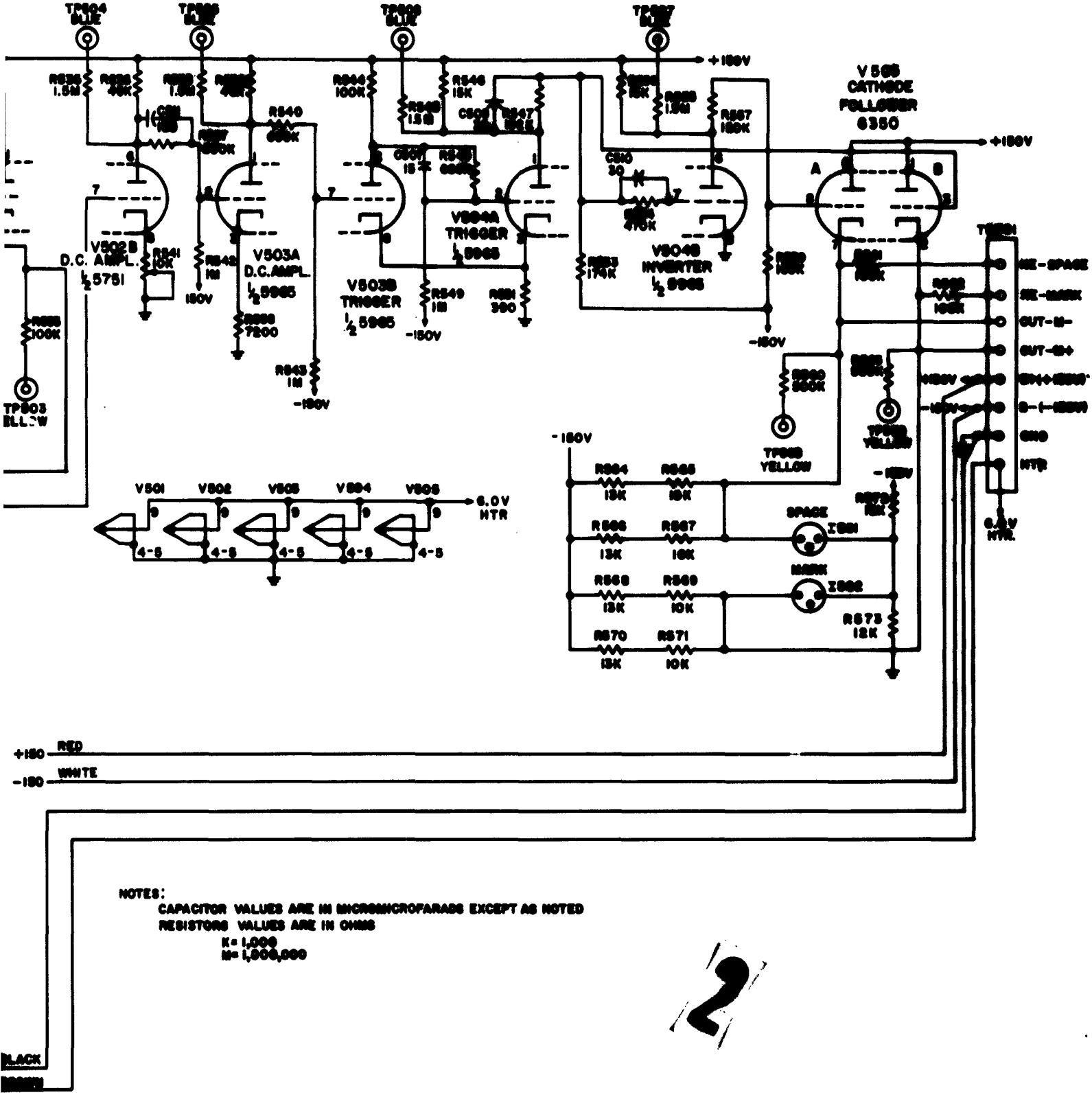

NOTES:
CAPACITOR VALUES ARE IN MICROMICROFARADS EXCEPT AS NOTED
RESISTORS VALUES ARE IN OHMS
K= 1,000
M= 1,000,000

Figure 3-3. FSK-2 Combiner Including DTC And Ratio-Squarer Modification

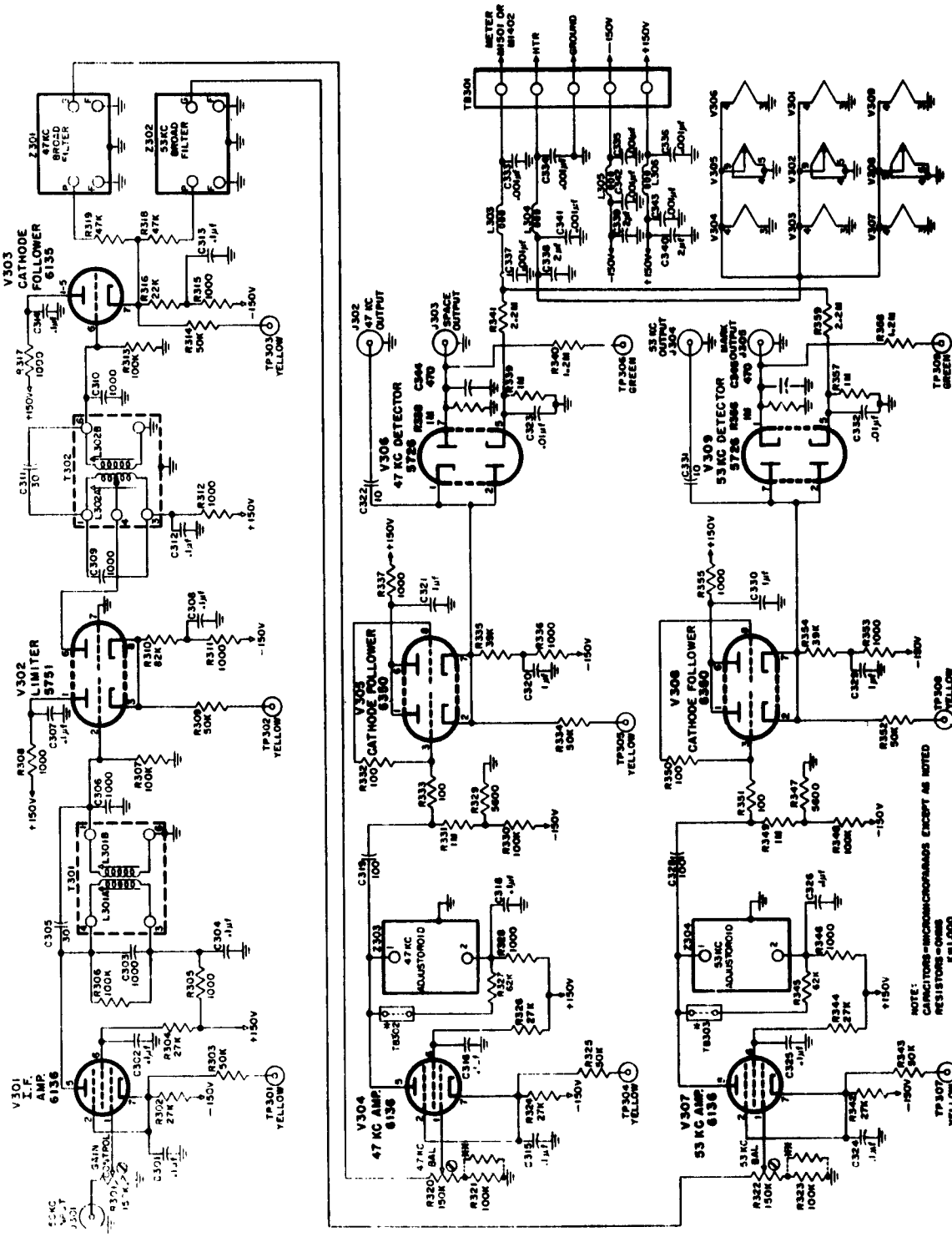

Figure 3-4. FSK-2 50-KC Amplifier (Revised)

APPENDIX A

MULTIPLEXING SYSTEM COMPATIBILITY

Most time-division multiplexing equipments used in scatter systems transmit telegraph signals which differ slightly from the "standard" 60-wpm signal. The multiplex equipments also differ from printing telegraph equipment in their tolerance of distortion of their input signals. As an example, an AN/FGC-5 Telegraph Receiving Group with an off frequency, start-stop oscillator in the receiving Telegraph Code Converter CV-94/FGC-5 may provide perfect copy on a page printer, but will fail to drive the transmitting code converter of the ES-8888 16-channel multiplexing equipment if the oscillator frequency is more than 5% low. The characteristics of various equipments are described below:

60-WPM Printing Telegraph

The standard telegraph signal is a 7.42 unit code, with a 163-millisecond character length, 368.1 operations-per-minute speed, 45.45-baud speed, six 22-millisecond pulses (start pulse and five intelligence pulses), and a 31-millisecond stop pulse. Most mechanical receiving devices permit adjustment of the sampling point of the input pulses with the "range" control. The speed of the transmitting and receiving equipment may vary due to mechanical wear or input voltage or frequency variations.

AN/FGC-5 Telegraph Terminal Set

The AN/FGC-5 equipment will accept the standard 368.1 operations-per-minute (OPM) signal described above. The speed may vary somewhat,

but may not be above 375 OPM, which is the maximum output speed of the AN/FGC-5. The output speed is accurately 375 OPM (± 0.001 %). If the input speed is under 375 OPM, the output signal will have pauses (no start pulse) to correct for the difference. The AN/FGC-5 signal is 45-baud speed, 7.20 units, with six 22.222-millisecond pulses and a 26.67-millisecond stop pulse. The 160-millisecond character length is determined accurately by the crystal oscillator in the Signal Distributor Drive unit, while the output pulse length is determined less accurately by the start-stop oscillator in the Telegraph Code Converter CV-94/FGC-5. This non-standard output signal from the AN/FGC-5 code converter will produce an indication of speed distortion on telegraph test equipment adjusted for 368.1 OPM.

ES-8888 Telegraph Terminal

The ES-8888 (MUX-16) equipment will accept the standard 368.1 OPM signal, and other speeds over a range 357 to 375 OPM. The output is accurately 375 OPM (0.00001 %). Speed-differential pauses appear in the output if the input speed is under 375 OPM. The output signal is 46.634-baud speed and has 160-millisecond character length, 21.44-millisecond pulses, and 31.34-millisecond stop pulse for a 7.46-unit code. In the transmitting code converter, each input pulse is sampled near the center and the stop pulse is sampled at about 142 milliseconds after the beginning of the start pulse. With a signal from the AN/FGC-5 applied to the ES-8888, the stop pulse is sampled about 8.5 milliseconds from its leading edge. Distortion greater than 8.5 milliseconds will cause incorrect operation.

UGC-1 Telegraph Terminal

The UGC-1 is the transistorized version of the FGC-5. It is capable of operating at 60, 75, or 100-wpm teletype speed, on 2, 3, or 4 channels. It is directly compatible with unmodified FGC-5, and is compatible with the modified FGC-5 on 4 channels at the 60-wpm rate.

UGC-3 Telegraph Terminal

The UGC-3 equipment is capable of operating at 60, 75, or 100-wpm teletype speed, on 4, 8, 12, or 16 channels. It is directly compatible with the UGC-1 and unmodified FGC-5, and with the modified FGC-5 on 4 or 8 channels at the 60-wpm rate.

APPENDIX B

FGC-5 MODIFICATION BILL OF MATERIALS

Item	Description	Quantity (for One Terminal)
1	Plug, multi-contact, with split-angle shell Amphenol AN-3108B-22-14P Use: P-509A, P-507A	4
2	Receptacle, multi-contact, box mounting Amphenol AN-3102A-22-14S Use: J-507A, J-509A	4
3	Clamp, cable Amphenol AN-3057-12 Use: P-507A, P-509A	4
4	Switch, rotary, non-shorting, 4 pole, two position, dia. 1-5/16", Centralab PA 1000 series, Type 1011 Use: S-504, S-506	2
5	Resistor, composition 560 ohms ±5%, 1/2 watt RC20BF561J Use: R-212B	2
6	Resistor, composition, 27K ±5%, 1/2 watt RC20BF273J Use: R-213B	2
7	Resistor, composition, 100K ±5%, 1/2 watt RC20BF104J Use: R-124	2
8	Resistor, composition, 240K ±5%, 1/2 watt RC20BF244J Use: R-144, R-147	4
9	Resistor, composition, 330K ±5%, 1/2 watt RC20BF334J Use: R-133	1
10	Resistor, composition, 470K ±5%, 1/2 watt RC20BF474J Use: R-211B	2

Item	Description	Quantity
11	Resistor, composition, 820K ±5%, 1/2 watt RC20BF824J Use: R-588, R-793B	2
12	Resistor, composition, 1 meg ±5%, 1/2 watt RC20BF105J Use: R-794B	1
13	Resistor, composition, 1.2 meg ±5%, 1/2 watt RC20BF125J Use: R-661	1
14	Resistor, composition, 1.8 meg ±5%, 1/2 watt RC20BF185J Use: R-795B, R-796B, R-797B, R-798B	8
15	Resistor, composition, 2.2 meg ±5%, 1/2 watt RC20BF225J Use: R-173	1
16	Capacitor, mica, 100 μμf ±5%, 500 vdcw CM20B101J Use: C-121	2
17	Capacitor, mica, 200 μμf ±5%, 500 vdcw CM20B201J Use: C-121	2
18	Capacitor, mica, 300 μμf ±5%, 500 vdcw CM20B301J Use: C-121	2
19	Capacitor, mica, 400 μμf ±5%, 500 vdcw CM20B401J Use: C-121	2
20	Capacitor, mica, 500 μμf ±5%, 500 vdcw CM20B501J Use: C-121, C-153B, C-535	5
21	Capacitor, mica, 3300 μμf ±5%, 500 vdcw CM30B332J Use: C-123	2
22	Capacitor, mica, 5000 μμf ±5%, 500 vdcw CM35B502J Use: C-100B	1

Item	Description	Quantity
23	Capacitor, paper, 0.02 ±10%, 600 vdcw Sprague GTM-S20 Use: C-303	2
24	Capacitor, paper, 0.1 ±10%, 600 vdcw Sprague GTM-P10 Use: C-152B	2
25	Wire, single-conductor, shielded, #18 AWG, stranded, glass braid MWC-18(12)BS Use: P-507A, P-509A	250 ft
26	Cable, coaxial, stranded, center conductor RG58c/u Use: P-507A, P-509A	50 ft
27	Wire, single conductor, stranded, #18AWG	100 ft
28	Tie points, single, insulated, Cinch-Jones #51	25
29	Plate, aluminum, 2-inches square, 0.125 inch thick Use: mount S-504A, S-506A	2
30	Screw, machine, round head, steel, 6-32NC2 x 1-1/4-inches Use: mount S-504A, S-506A	100
31	Nut, machine, hex, steel, 6-32NC2 Use: mount S-504A, S-506A	100
32	Washer, lock, tooth, external teeth, steel for #6 Use: mount S-504A, S-506A	100
33	Plate, aluminum, 2 x 18 x 0.0625-inch Use: cover unused tube sockets	1

APPENDIX C

BILL OF MATERIALS FOR FSK-2 RECEIVER MODIFICATION

Quantity (for One Terminal)	Description	Manufacturer
1	Decision Threshold Computer	Rixon
1	Grommet, rubber, 3/8 inch	Hermon H. Smith Inc., No. 2170
4	Resistor, Composition: 270,000 ohms, ±5%, 1/2 watt, RC20GF274J	
2	Terminal, stand-off, ceramic	Cambridge Thermionic Corp., X2045-F4
2	Screw, machine, flathead, cadmium-plated, 4-40 x 1/4 inch	
2	Washer, lock, steel, cadmium-plated, external-tooth, No. 4	
1	Bracket, cover, receptacle	
2	Screw, machine, binderhead, cadmium-plated, 6-32 x 3/8 inch	
2	Nut, machine, cadmium-plated, 6-32 x 5/16-inch	
2	Washer, lock, steel, cadmium-plated, external-tooth, No. 6	
2	Washer, lock, steel, cadmium-plated, internal-tooth, No. 6	